A.O.Smith *Service Handbook*

Cyclone XHE®

Extra-High Thermal Efficiency

MODELS COVERED

BTH Models 120 through 250

Series 960 through 967, 970 and 973

A.O.Smith Water Heaters

Part No. TC-044R6 • Printed in the U.S.A. • 1105

Downloaded from www.Manualslib.com manuals search engine

BTH Service Handbook

TABLE OF CONTENTS

Introduction 2

Installation
Clearances 3
Gas Requirements 3
Venting . . . . . 4 – 8
Air Requirements . . . . . 9 – 11
Contaminated Air 12
Flammable Items 12
Multiple Unit Piping 13
Condensation 14

Operation
Sequence of Operation 15
Controls 16
Circuit Boards 17

Troubleshooting
Pre-Service 18
120 VAC to Control 18
Transformer . . . . . 19 – 20
ECO Check . . . . . 21 – 22
Temperature Probe 23
Pressure Switch Continuity 24
Blower . . . . . 25 – 26
Pressure Switch Performance . 27 – 28
120 VAC to Ignitor . . . . . 29 – 30
Ignitor Resistance 31
Gas Valve Test 32
Gas Pressure Check 33

Component Information
Orifice Tables 34
Pressure Switches . . . . . 35 – 36

Wiring Diagrams 37

Service Aids 38
BTH Muffler 39

Questions & Answers 40

Error Codes 41

Service Checklist 42

Parts Lists
970 & 973 Series . . . . . 43 – 47
966 & 967 Series . . . . . 48 – 59
960 Series . . . . . 60 – 63
962 Series . . . . . 64 – 71

Downloaded from www.Manualslib.com manuals search engine

INTRODUCTION

This service handbook is designed to aid in servicing and troubleshooting A. O. Smith BTH 120 – 250 water heaters. No duplication or reproduction of this book may be made without the express written authorization of the A. O. Smith Water Products Company.

The following text and illustrations will provide you with a step by step procedure to verify proper installation, operation and troubleshooting procedures. Additional quick reference data is included to assist you in servicing this product.

The information contained in this handbook is designed to answer commonly faced situations encountered in the operation of the BTH product line and is not meant to be all inclusive. If you are experiencing a problem not covered in this handbook, please contact the A. O. Smith Technical Information Department at 1-800-527-1953 or your local A. O. Smith Water Products Company Representative for further assistance. This handbook is intended for use by licensed plumbing professionals and reference should be made to the instruction manual accompanying the product. This handbook contains supplemental information to the BTH instruction manual.

Qualifications: Installation or service of this water heater requires ability equivalent to that of a licensed tradesman in the field involved. Plumbing, venting, gas supply and electrical testing skills are required.

Tools Required:

- Phillips head and flat tip screw drivers
- Set of marked drill bits
- Electric multimeter tester
- Gas pressure gauge or manometer (gauge — AOS part number 8099-2)
- Water pressure gauge (A OS part number 4798)
- Digital manometer or draft gauge
- Thermometer (AOS part number 4870 — range 0 thru 220°F)
- 1/2", 1" and 1 1/8" sockets
- Pipe wrench for union disconnect

NOTE Also, have a copy of the instruction manual for the model and series BTH that you are servicing.

Revision 2 includes:

- an added Multiple Venting statement on page 3 and a new Blower Motor Ohms Resistance Table on page 25. The Pressure Switch Table on page 32 was expanded/revised.

Revision 3 includes:

- clarification to Step 13, 14 and 15 Test.
- BTH 120 Propane information on pages 31, 32, and the Parts List.
- revised part number — page 34, Step 11.

Revision 4 dated 04/02 includes:

- expanded error code information on page 36.

†Revision 4 dated 04/03 includes:

- revised sequence of troubleshooting. Minor corrections.

Revision 6 includes:

- 970 & 973 Series product information. Minor corrections.

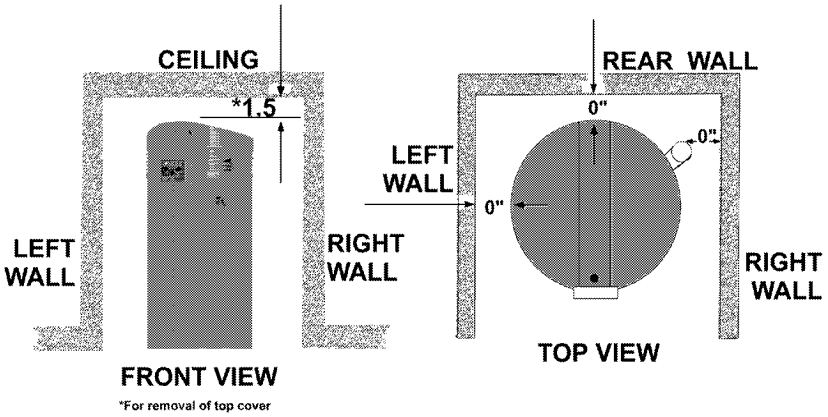
†. Handbook cover should have stated revision 5.

Downloaded from www.Manualslib.com manuals search engine

INSTALLATION

CLEARANCES

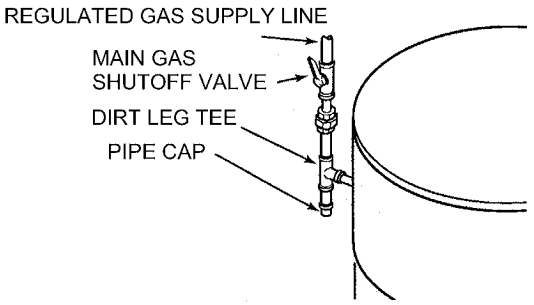
This portion of the handbook will review often overlooked installation requirements. The installation manual covers these items in detail. BTH water heaters are approved for installation on combustible flooring. The minimum clearance to combustibles or non-combustibles is 0 inches from the sides and rear, 0 inches from vent piping, and 1.5 inches from the top cover. A 24 inch clearance for all serviceable parts is recommended. Clearances may vary between BTH models. See installation manual or the label on the heater for your specific model.

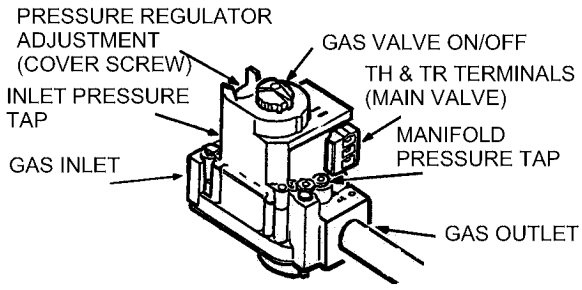


GAS REQUIREMENTS

N O T E : Pressure without capacity will result in lockout. Follow the piping guidelines in the installation manual. The supply gas pressure is normally measured at the dirt leg or at the inlet gas pressure tap on the gas valve. This reading must be measured with 'flowing' gas.

The manifold gas pressure is measured at the manifold pressure tap on the gas valve when the gas is flowing. The gas valves used on all BTH water heaters are 24 VAC combination step opening gas valves. They incorporate the main valve and pressure regulator into one body.





GAS SUPPLY SPECIFICATIONS	BTH 120 & 250	BTH 150 & 199	BTH 120, 150 & 199
	NATURAL GAS	NATURAL GAS	PROPANE GAS
Max. Gas Supply Pressure Inches W.C.	12.0 (3 kPa)	12.0 (3 kPa)	14.0 (3.45 kPa)
Nominal Gas Supply Pressure Inches W.C.	7.0 (1.75 kPa)	7.0 (1.75 kPa)	11.0 (2.74 kPa)
Minimal Gas Supply Pressure Inches W.C.	5.5 (1.37 kPa)	4.5 (1.12 kPa)	11.0 (2.74 kPa)
Manifold Pressure Inches W.C.	4.0 (1 kPa)	3.5 (0.8 kPa)	10.0 (2.5 kPa)

Downloaded from www.Manualslib.com manuals search engine

VENTING

Equivalent Feet of Pipe Intake or Exhaust

VENT LENGTH TABLE			
NUMBER OF 90° ELBOWS	**3" MINIMUM PIPE (FEET)**	**3" MAXIMUM PIPE (FEET)**	**4" MAXIMUM PIPE (FEET)**
ONE (1)	7	45	115
TWO (2)	7	40	110
THREE (3)	7	35	105
FOUR (4)	7	30	100
FIVE (5)	7	--	95
SIX (6)	7	--	90

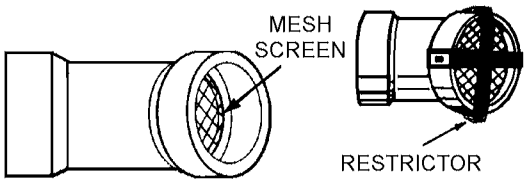
4-inch PVC may be used for a MAXIMUM intake of ONE HUNDRED TWENTY (120) EQUIVALENT FEET and a MAXIMUM exhaust of ONE HUNDRED TWENTY (120) EQUIVALENT FEET. The maximum number of 90° elbows with the 4-inch venting is six (6) on the intake and six (6) on the exhaust. A 90° elbow is equal to five (5) equivalent feet of pipe. One (1) 90° elbow is equal to two (2) 45° elbows. Any venting configuration using less than 50 equivalent feet should use 3-inch venting. See Vent Length Table.

The 3-inch venting terminals (provided) must be used with the 4-inch venting by adding 4 x 3 reducing coupling at the venting terminals. A reducing coupling is also needed immediately after the condensate elbow (exhaust) and immediately before the 3-inch blower adapter (intake) if direct venting is installed. See Vent Length Table.

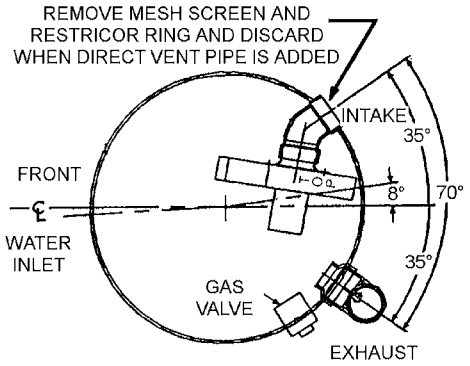
DIRECT VENTING

The air intake provided on the unit contains a mesh screen (see Figure below) to prevent large particles from entering the unit.

3" (7.6CM) 45° PVC ELBOW WITH MESH SCREEN

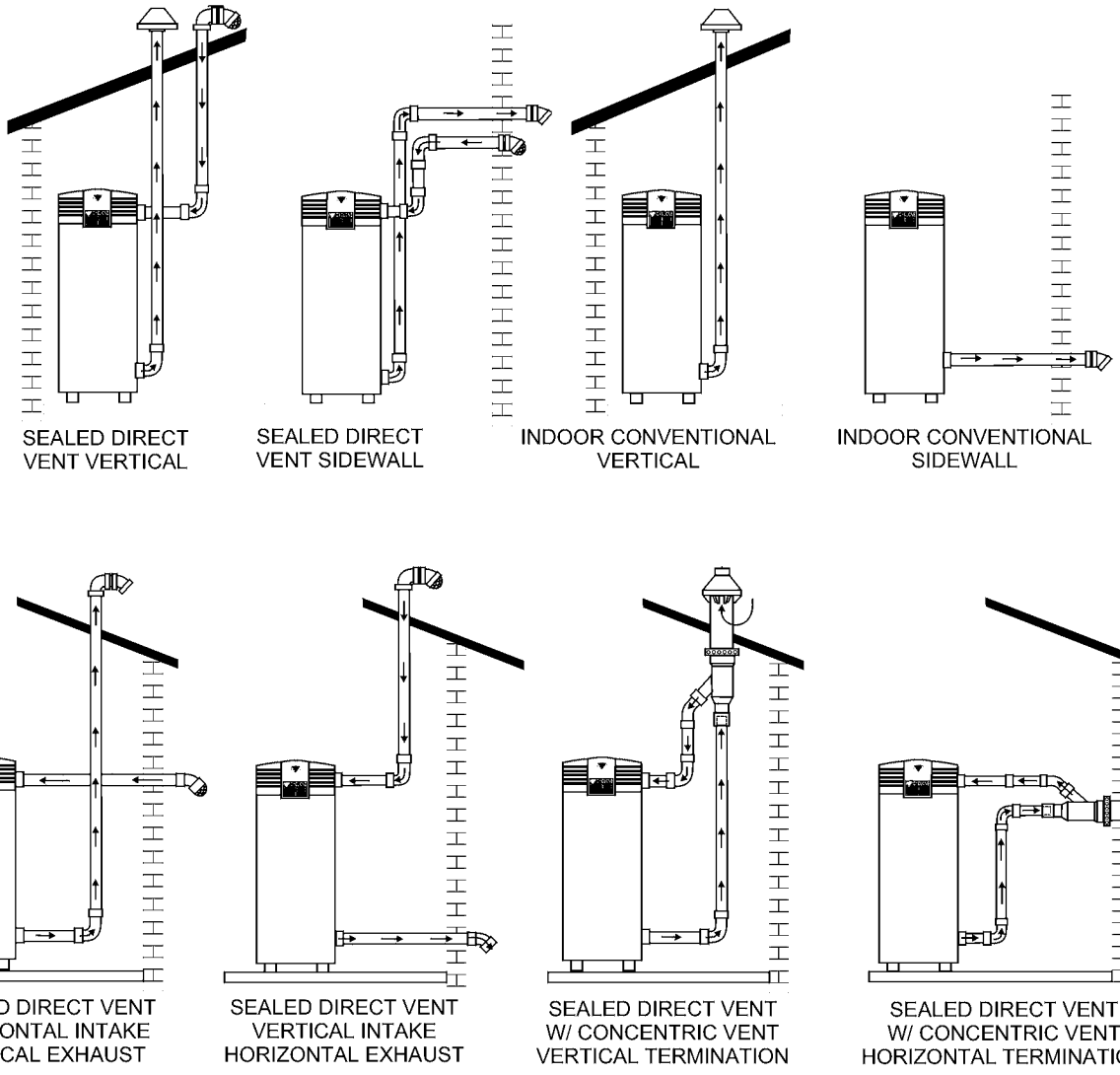


WARNING WHEN THE UNIT IS TO BE SETUP AS A DIRECT VENT, THE MESH SCREEN MUST BE REMOVED. THE INLET VENT PIPE MAY THEN BE GLUED TO THE AIR INTAKE (see following Figure) PROVIDED ON THE UNIT.



Downloaded from www.Manualslib.com manuals search engine

VENTING CONFIGURATIONS


SEALED DIRECT VENT VERTICAL
SEALED DIRECT VENT SIDEWALL
INDOOR CONVENTIONAL VERTICAL
INDOOR CONVENTIONAL SIDEWALL
SEALED DIRECT VENT HORIZONTAL INTAKE VERTICAL EXHAUST
SEALED DIRECT VENT VERTICAL INTAKE HORIZONTAL EXHAUST
SEALED DIRECT VENT W/ CONCENTRIC VENT VERTICAL TERMINATION
SEALED DIRECT VENT W/ CONCENTRIC VENT HORIZONTAL TERMINATION

VENTING MATERIALS

This unit can be vented using only PVC (Class 160, ASTM D-2241; Schedule 40, ASTM D-1785; or Cellular Core Schedule 40 DWV, ASTM F-891), Schedule 40 CPVC (ATSM F-411), or ABS (ASTM D-2661) pipe. The fittings, other than the TERMINATIONS should be equivalent to PVC-DWV fittings meeting ASTM D-2665 (Use CPVC fittings, ASTM F-438 for CPVC pipe and ABS fittings, ASTM D-2661/3311 for ABS pipe. If CPVC or ABS pipe and fittings are used, then the proper cement must be used for all joints, including joining the pipe to the Termination Tee (PVC Material). PVC Materials should use ASTM D-2564 Grade Cement; CPVC Material should use ASTM F-493 Grade Cement and; ABS Materials should use ASTM D-2235 Grade Cement.

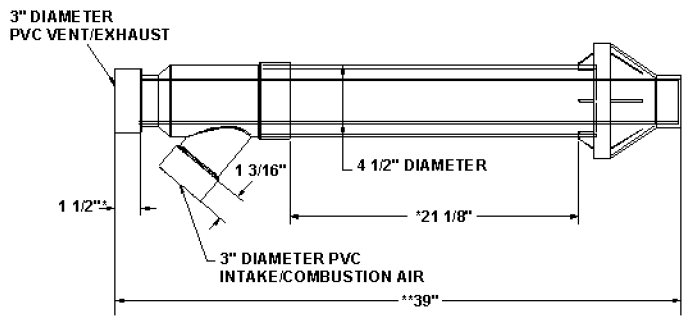
For water heaters in locations with high ambient temperatures (above 100°F) and/or insufficient dilution air, it is recommended that CPVC or ABS pipe and fittings (MUST USE SUPPLIED VENT TERMINAL) be used.

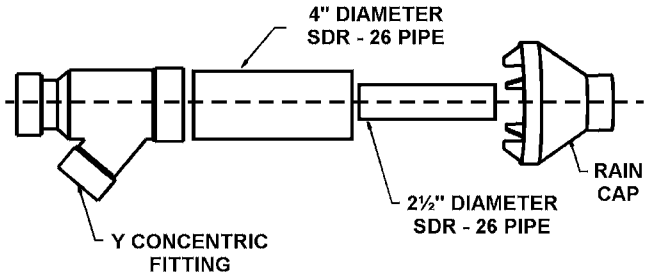
Downloaded from www.Manualslib.com manuals search engine

CONCENTRIC VENT TERMINATION

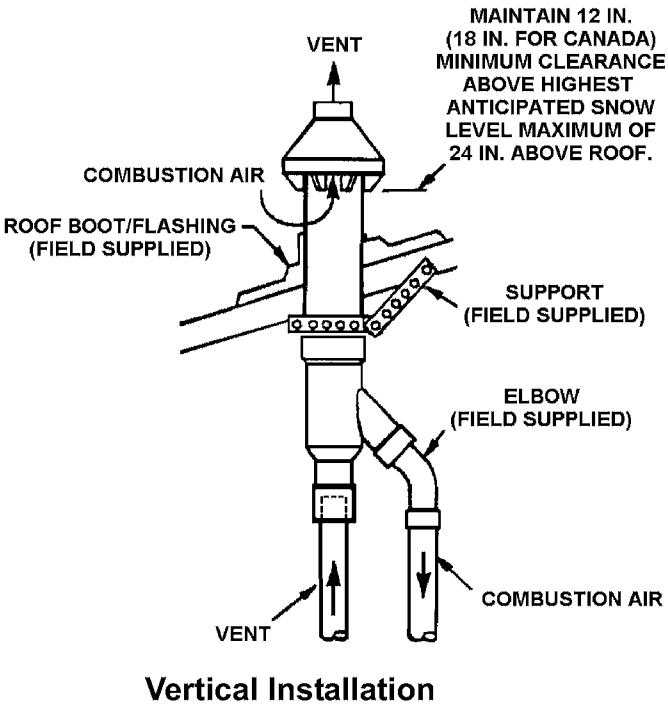
The concentric vent termination kit, Part No. 194451-000 can be used on BTH 120 – 250 Cyclone XHE water heaters. It adds zero equivalent feet to the vent system. Below are some general application and installation guidelines for the concentric vent kit. Refer to the accompanying literature and the water heater installation manual for complete venting installation instructions.

This concentric vent termination kit may be used with 3 or 4 in. diameter pipe systems. When connecting to a 4 in. diameter pipe system a 3 x 4 in. field supplied reducer is to be installed at the intake and exhaust connection of the concentric vent termination kit. See water heater installation and operation manual for venting specification

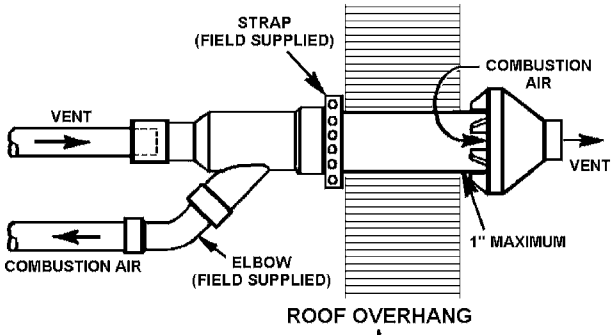


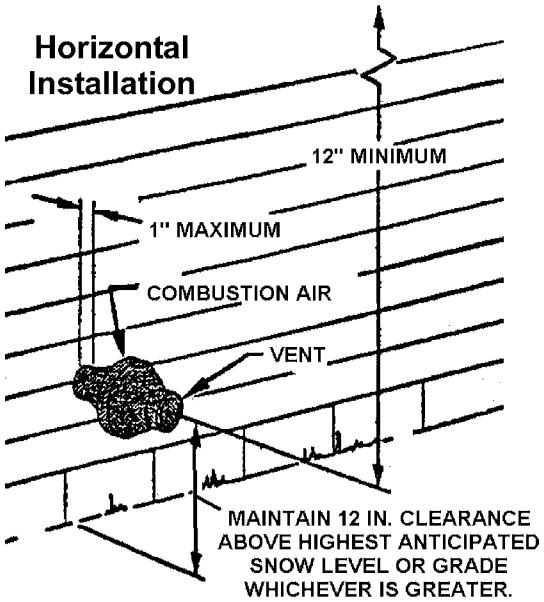


Dimension 21 1/8 in. may be lengthened to 60 in. maximum. Dimension 21 1/8 in. may also be shortened by cutting the pipes, provided in the kit, to 12 in. minimum. Dimension 39 will change accordingly as dimension 21 1/8 in. is lengthened or shortened



Vertical Installation





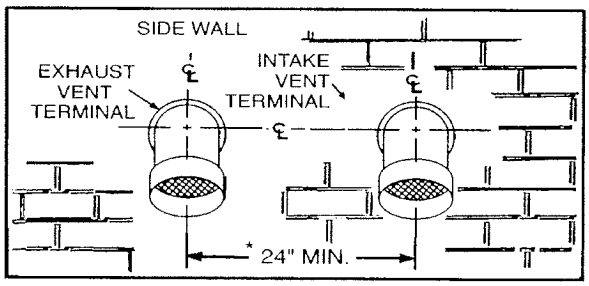
Downloaded from www.Manualslib.com manuals search engine

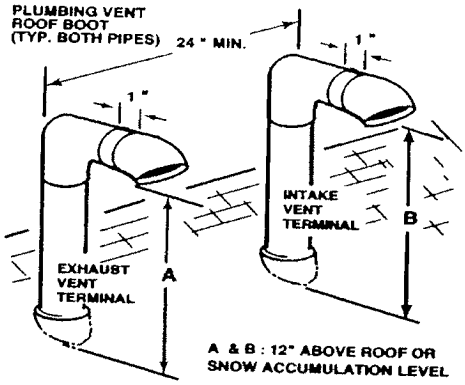
VENTING CLEARANCES

This illustrates the exterior clearances for these BTH units when installed as direct vent heaters.

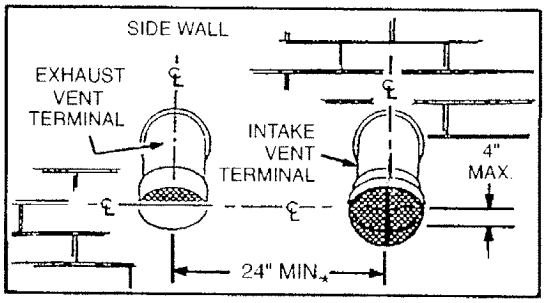
N O T E : 24 inches between inlet and outlet is a MINIMUM. Greater distance is recommended. In colder climates increasing the 24" minimum to a maximum practical distance will reduce the possibility of frost over from side winds blowing exhaust vapors into the air intake.

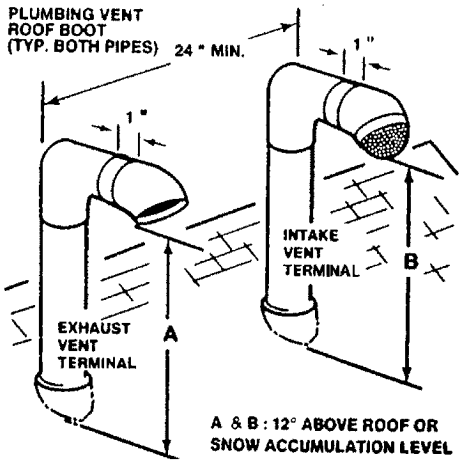
BTH MODEL 120



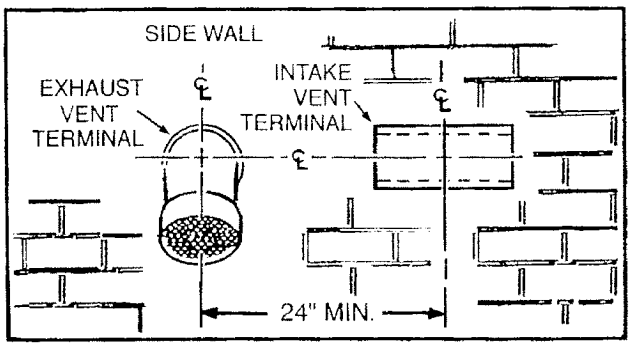


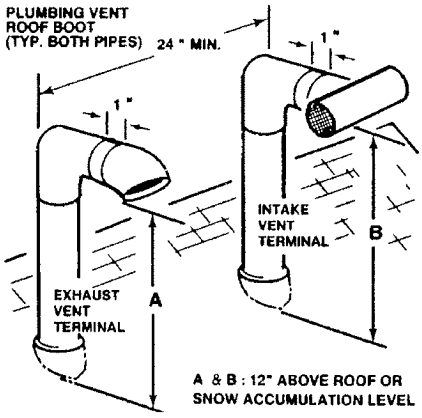
BTH MODEL 150 – 199





BTH MODEL 250

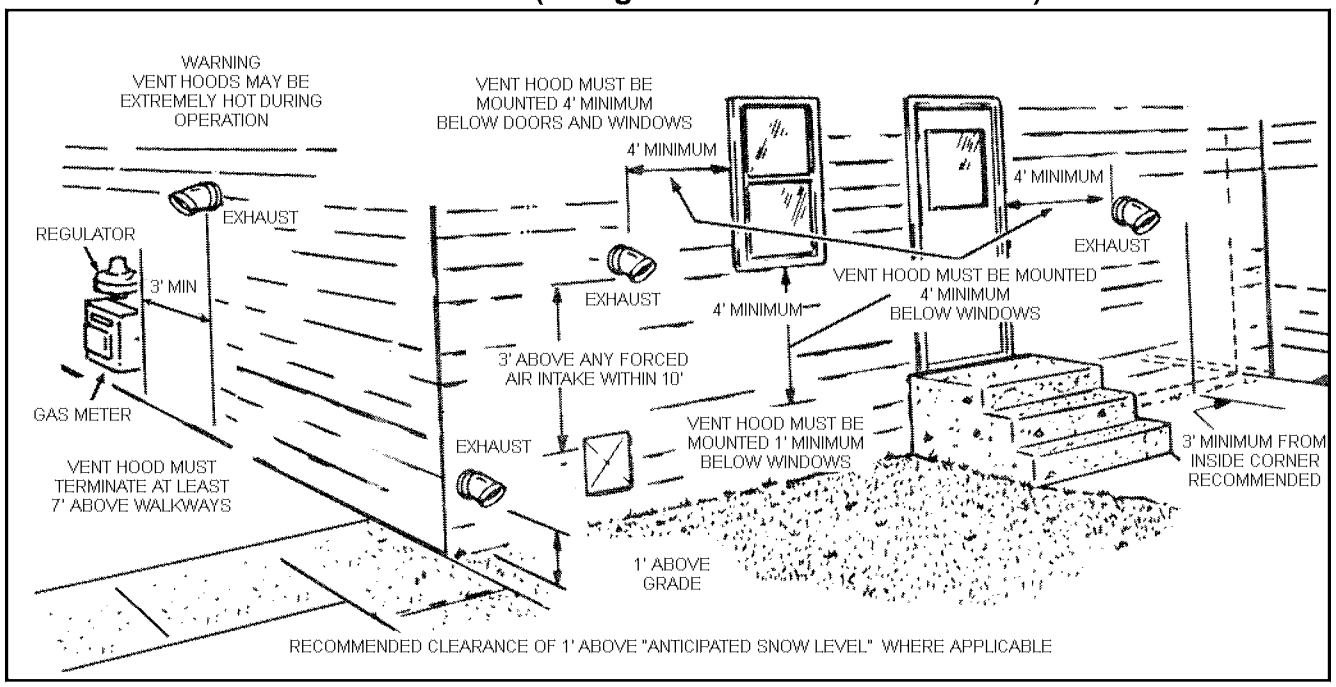




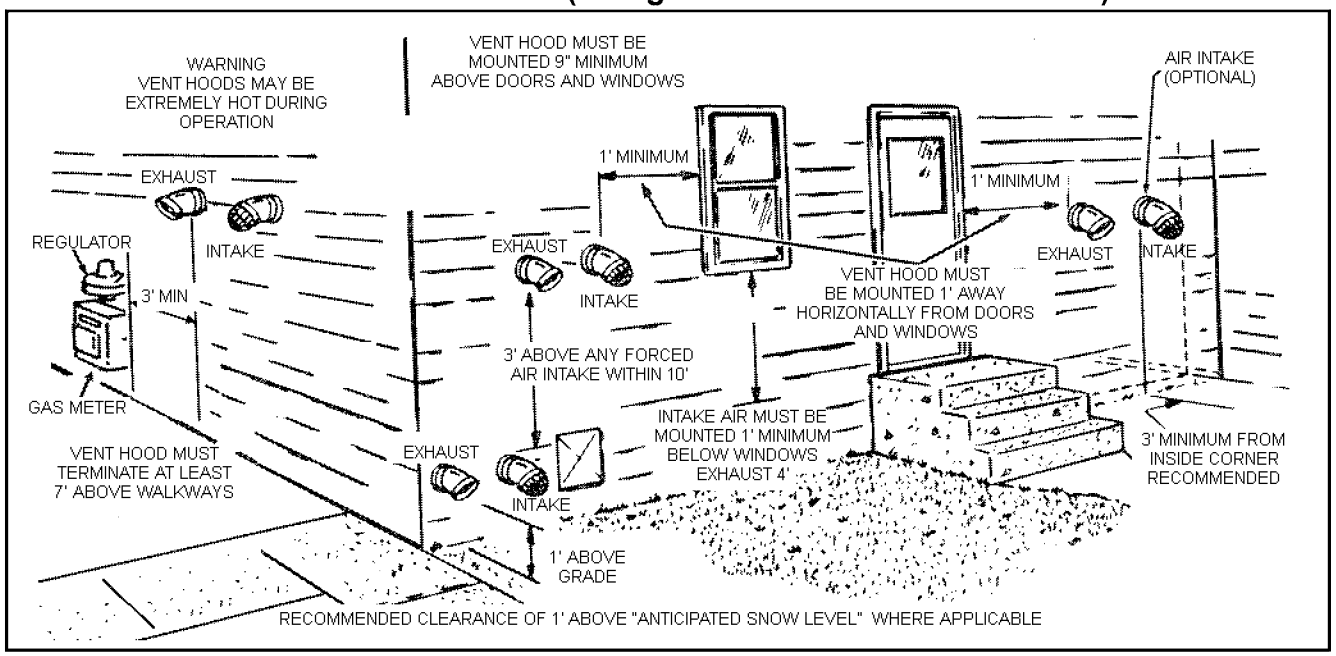
Downloaded from www.Manualslib.com manuals search engine

EXTERIOR SIDEWALL CLEARANCES

Horizontal Vent (Using Room Air for Combustion)



Horizontal Direct Vent (Using Outdoor Air for Combustion)



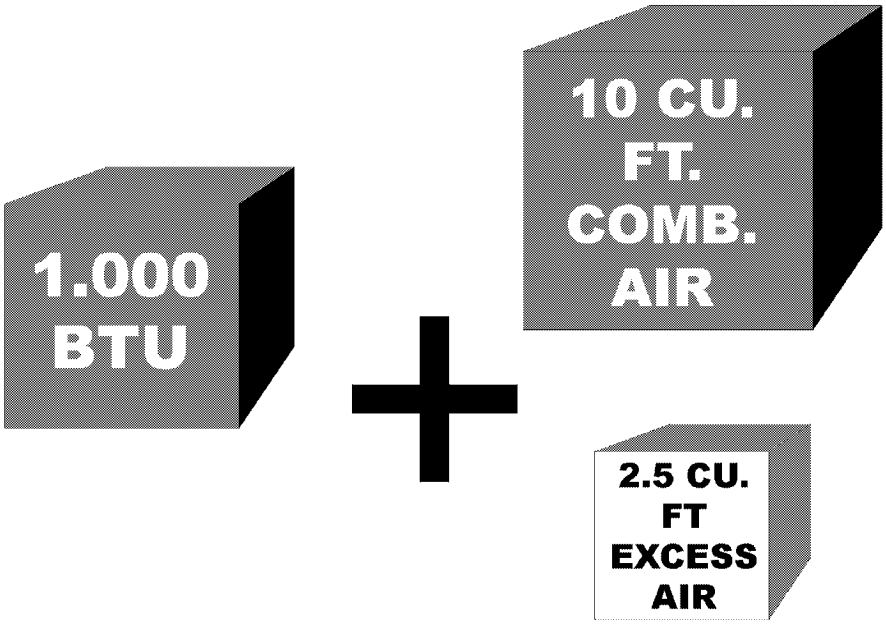
When multiple units are directly vented through a wall, all intake vent terminals must be no lower than the highest exhaust vent terminal.

CAUTION DO NOT TERMINATE THE VENTING WHERE NOISE FROM THE EXHAUST OF INTAKE WILL BE OBJECTIONABLE. THIS INCLUDES LOCATION CLOSE TO OR ACROSS FROM WINDOWS AND DOORS. AVOID ANCHORING THE VENT AND INTAKE PIPES DIRECTLY TO FRAMED WALLS, FLOORS OR CEILINGS UNLESS RUBBER ISOLATION PIPE HANGERS ARE USED. THIS PREVENTS ANY VIBRATIONS FROM BEING TRANSMITTED INTO THE LIVING SPACES.

Downloaded from www.Manualslib.com manuals search engine

AIR REQUIREMENTS

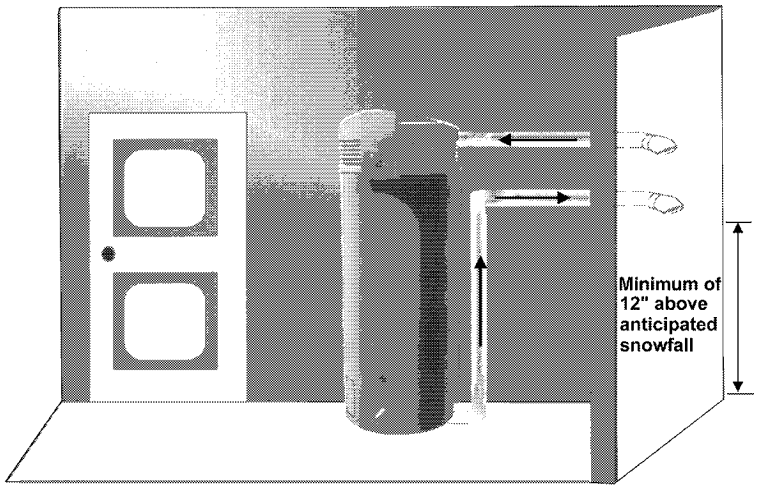
MINIMUM AIR FOR COMBUSTION
10 Cubic Feet of Air Per 1000 BTUH



Stoichiometric or theoretical complete combustion requires 10 cubic feet of air per 1000 BTUH of gas input. The National Fuel Gas Code also recommends an additional 2.5 cu.ft. of “excess air”. This 12.5 cu.ft. minimum supply air per 1000 BTUH input applies to natural and propane gas models.

The National Fuel Code also specifies minimum make-up air opening sizes for various building installations (Ref: NFPA 54, ANSI Z223.1, sec 5.3).

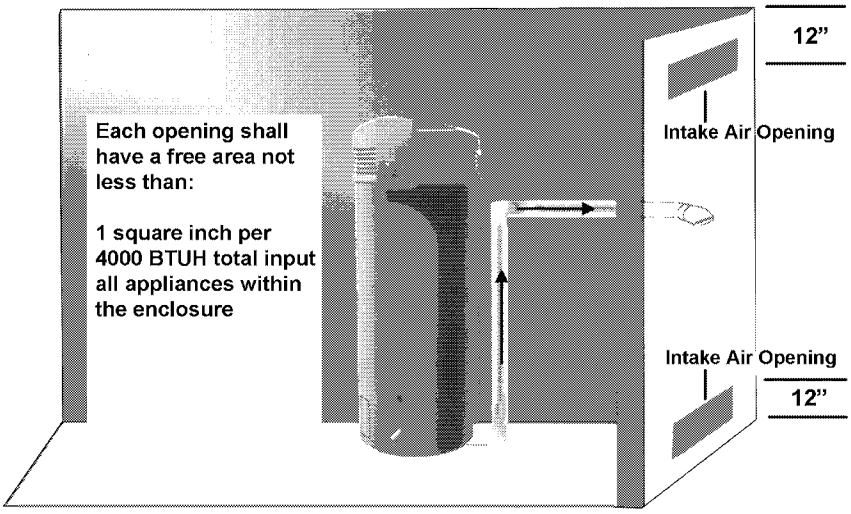
MAKE-UP AIR
Direct Vent Installation



This model is approved for direct venting either horizontally or vertically or conventional venting horizontal or vertical. Direct venting avoids using room air for combustion and eliminates the need for additional air intake ducts.

Downloaded from www.Manualslib.com manuals search engine

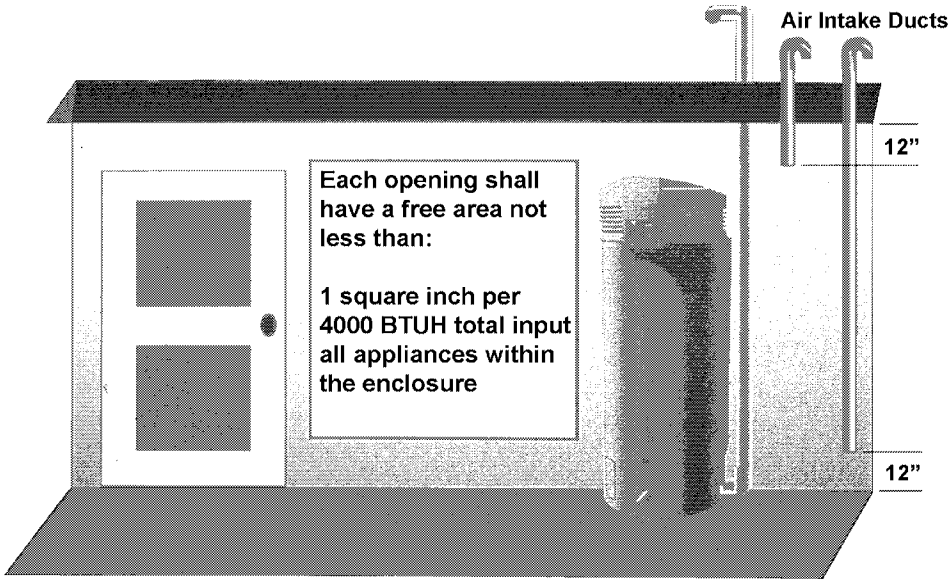
MAKE-UP AIR
Direct Communication


12"
Intake Air Opening
Each opening shall have a free area not less than:
1 square inch per 4000 BTUH total input all appliances within the enclosure
Intake Air Opening
12"

A fresh supply of make-up air for combustion can be supplied to the heater through make-up air openings, which directly communicate with the out of doors. Two openings are required — one within 12 inches of the top of the enclosure and one within 12 inches of the bottom of the enclosure. Each opening shall have a free area of not less than 1 square inch per 4000 BTUH of the total input of all appliances within the enclosure.

The lower opening is primarily providing combustion air. The upper opening is providing vent dilution air and acts as a relief opening for flue gases should the vent become obstructed or a down draft condition occur.

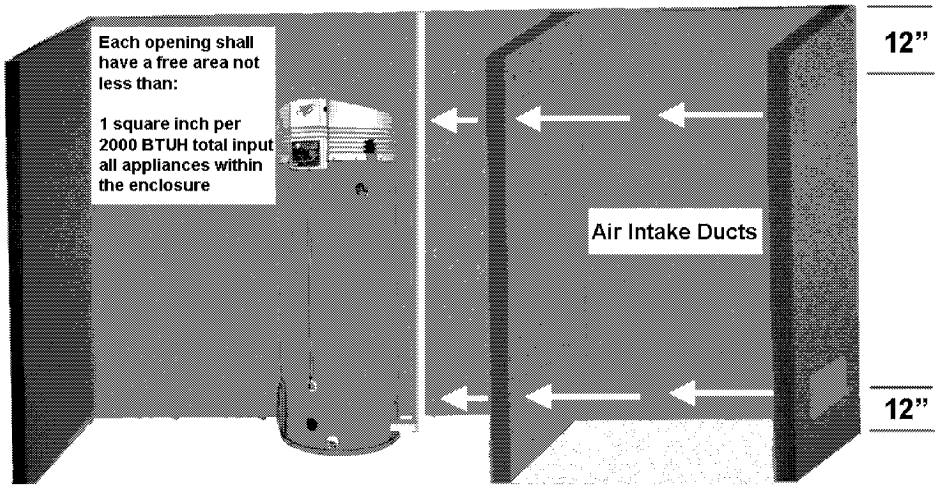
MAKE-UP AIR
Vertical Ducts


Air Intake Ducts
12"
Each opening shall have a free area not less than:
1 square inch per 4000 BTUH total input all appliances within the enclosure
12"

Often it is more practical to install vertical make-up air ducts to the outdoors. Again, two openings are required — within 12 inches (30 cm) of the top of the enclosure and one within 12 inches (30 cm) of the bottom of the enclosure. Each opening shall have a free area of not less than 1 square inch per 4000 BTUH of the total input of all appliances within the enclosure.

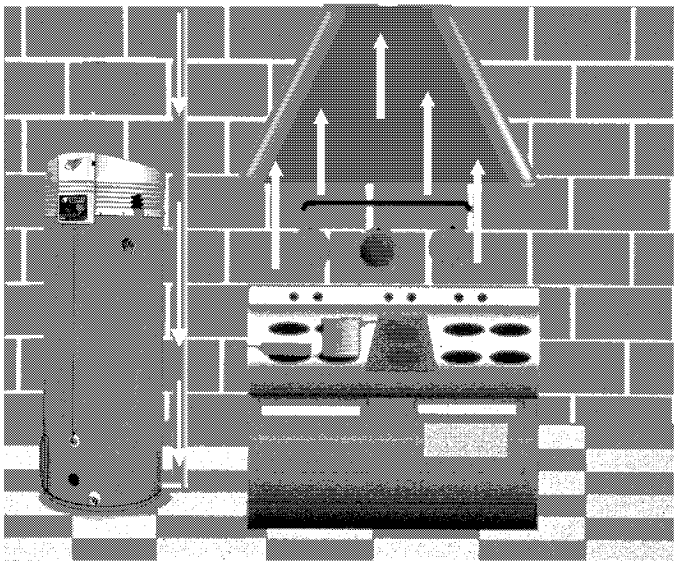
Downloaded from www.Manualslib.com manuals search engine

MAKE-UP AIR
Horizontal Ducts


Each opening shall have a free area not less than:
1 square inch per 2000 BTUH total input all appliances within the enclosure
12”
Air Intake Ducts
12”

When the heater is installed in an interior room with no roof access for vertical ducts, horizontal make-up ducts should be installed. When using horizontal ducts, two openings are required - within 12 inches (30 cm) of the top of the enclosure and one within 12 inches (30 cm) of the bottom of the enclosure. Each opening shall have a free area of not less than 1 square inch per 2000 BTUH of the total input of all appliances within the enclosure.

INSUFFICIENT MAKE-UP AIR
Backdraft



Insufficient make-up air is a major cause of combustion problems. One common example is in a restaurant installation where exhaust vent equipment was not considered in sizing make-up air requirements. This may result in air being backdrafted by the restaurant exhaust equipment through the heater causing flue gas spillage, flame roll out, improper combustion, inconsistent pilot operation, and/or erratic heater shutdown.

A possible solution to this situation would be to use a BTH with direct venting.

A less common service issue associated with a backdraft or negative pressure room would be the opening or closing of air pressure switches. This may result in erratic or no heater operation.

Downloaded from www.Manualslib.com manuals search engine

CONTAMINATED AIR

Along with adequate make-up air, the quality of the air is important. Contaminants in combustion air can lead to premature heater failure. Vapors from bleaches, soaps, salts, etc. are drawn into the combustion chamber with the make-up air and, once fired, mix with water vapor in the gasses to form extremely corrosive hydrochloric or hydrofluoric acid and other corrosive by-products. Dust drawn in may build up on the blower or clog the main burner ports. Also, be certain to examine the exterior area around the air intake of a direct vent installation for the contaminants.

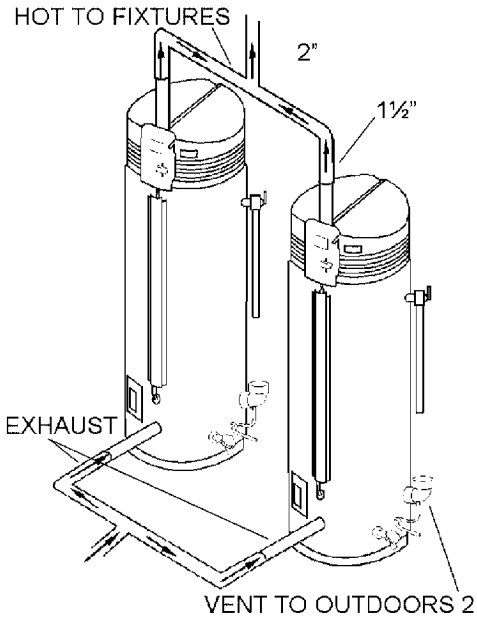
FLAMMABLE ITEMS

Flammable items or pressurized containers or any other potentially hazardous articles must never be placed on or adjacent to the heater. Open containers of flammable material should not be stored or used in the same room with the heater or in the area of the exterior air intake of a direct vent installation. Direct venting **does not** eliminate the need to remove flammable or corrosives from the area surrounding the heater.

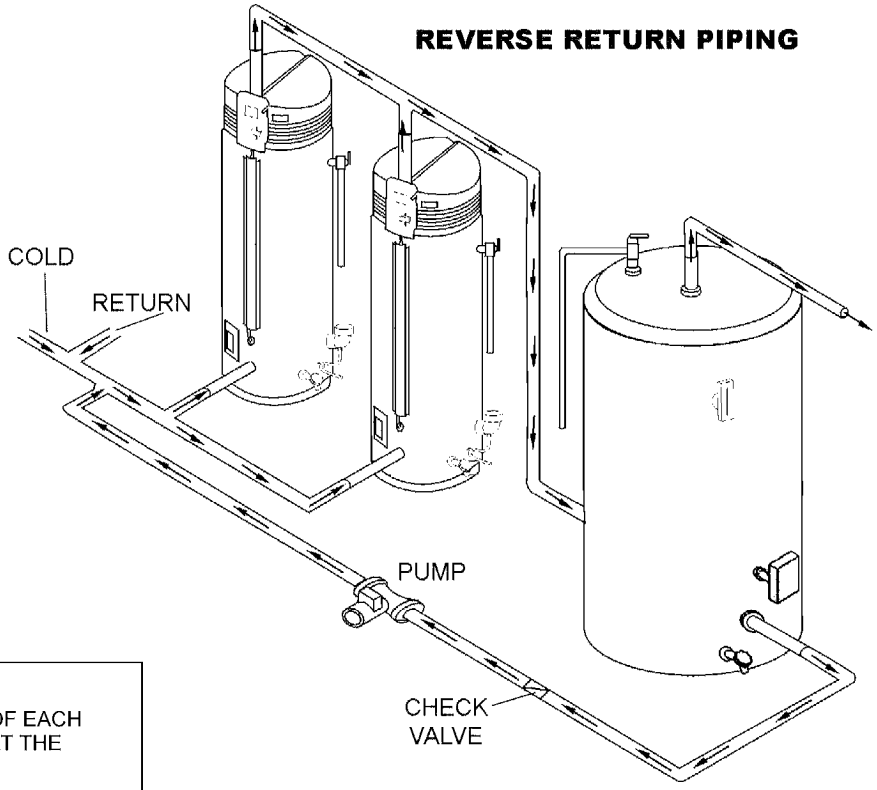
Downloaded from www.Manualslib.com manuals search engine

MULTIPLE UNIT — WATER PIPING

PARALLEL PIPING



REVERSE RETURN PIPING



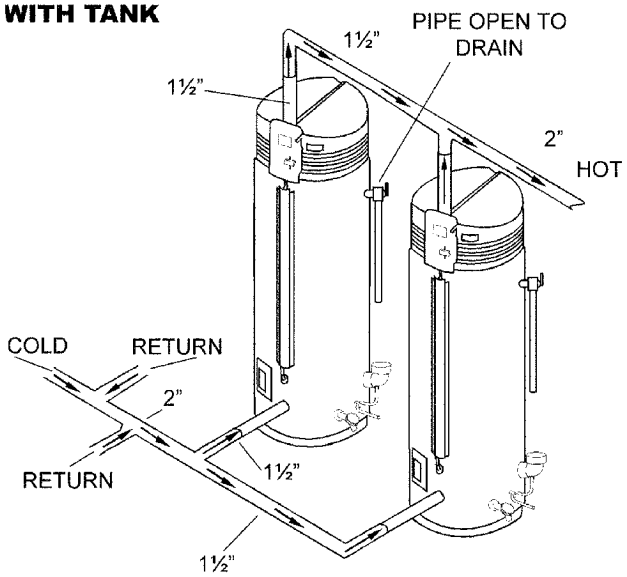
NOTES APPLY TO ALL SYSTEMS:
*ADD GATE VALVES TO INLET AND OUTLET OF EACH UNIT FOR ISOLATION FLEXIBILITY. LOCATE AT THE SAME POINT FROM TEE.

** ADD THERMAL EXPANSION TANK TO COLD WATER SUPPLY IF NECESSARY.

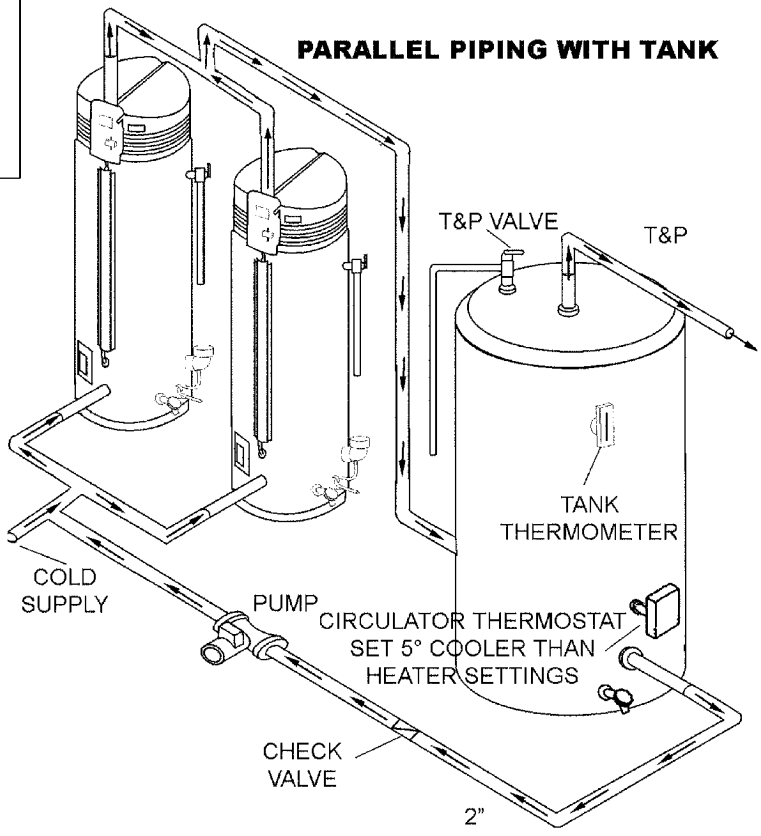
CONDENSATION HOSE MUST BE ALLOWED TO DRAIN.

NOTE: T&P VALVES MUST BE PIPED TO OPEN DRAIN OR PER LOCAL CODE

REVERSE RETURN PIPING WITH TANK



PARALLEL PIPING WITH TANK



Downloaded from www.Manualslib.com manuals search engine

CONDENSATION

The average dewpoint of natural gas flue products is 127° F. Propane flue products is 119° F. With 70° F ambient air temperature and 180° F stored water temperature, exhaust gas will be approximately 140° F. Recommended starting point for water storage is 120° F.

The extra high thermal efficiency of the BTH will result in condensation in the flue passage. The following answers common questions about this condensation.

CAN I DRAIN THIS CONDENSATION TO A FLOOR DRAIN? The "Corrosion Resistance of Cast Iron Soil Pipe" by the Ductile Metals Association (formally the Cast Iron Soil Pipe Institute) states that:

"Internal corrosion of cast iron soil pipe and fittings can be caused by strong acids or other reagents having an acidity of pH 4.3 or less if allowed to contact cast iron pipe for an extended period of time without sufficient dilution to raise the pH valve about 4.3. By avoiding low pH discharges, internal corrosion problems can be limited or eliminated, assuring the owner many years of service."

WHAT ABOUT THE pH VALUES OF CONDENSATE AND SODA POP? The pH of the BTH condensate average 4.5 which is approximately 4 times less concentrated than the limit of 4.3 recommended by the DMA. Any water flow in the drain rapidly dilutes the condensate even more. A can of leading carbonated cola drink measured a pH of 2.5 which is 300 times more concentrated than the BTH condensate.

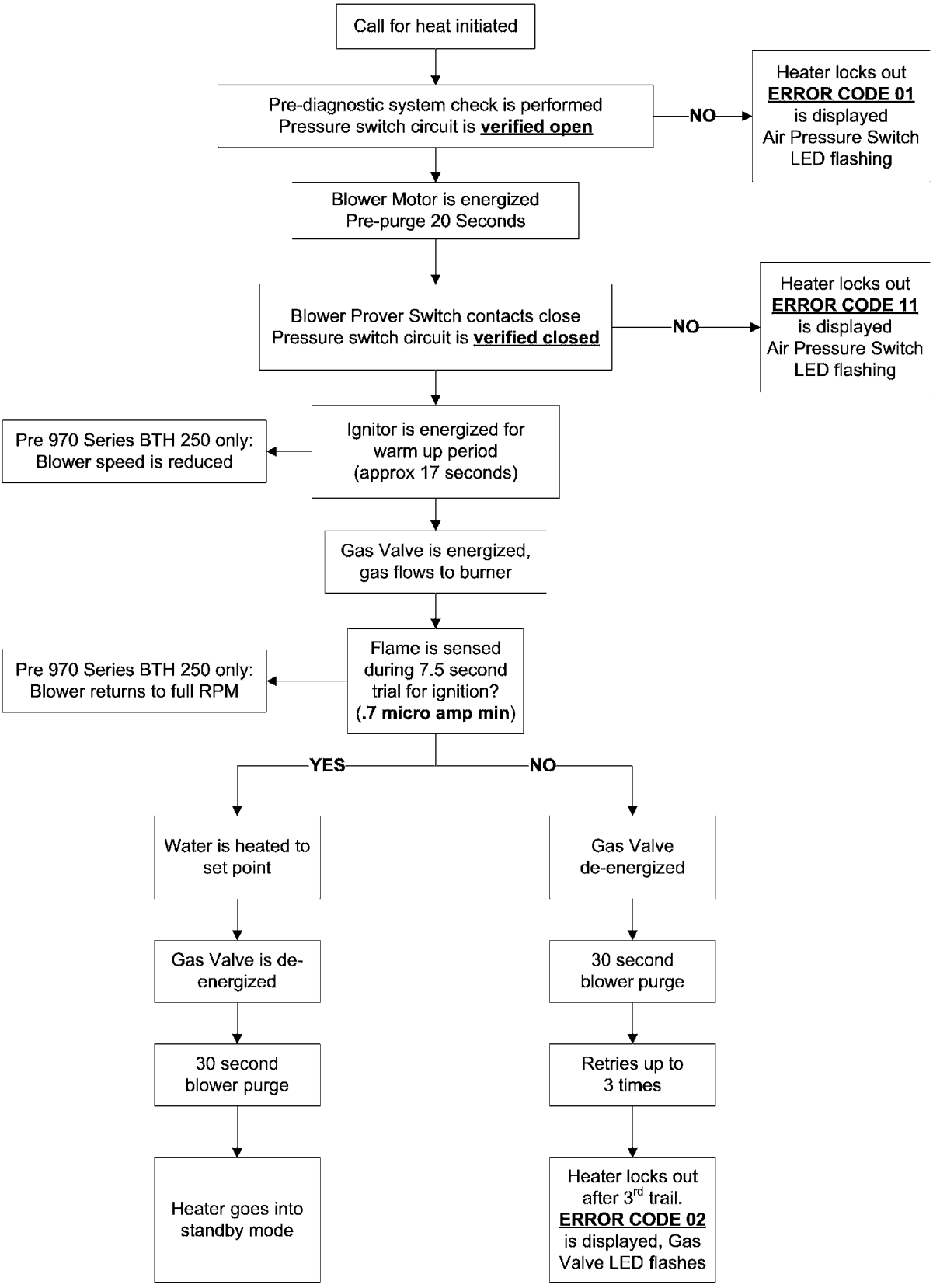
WHAT DOES THE pH SCALE MEAN? The pH value is a measure of acidity of alkalinity. A pH of 7 is neutral. Numbers from 7 to 1 indicate increasing acidity and numbers from 7 to 14 indicate increasing alkalinity. The pH scale is similar to the Richter scale used to measure earthquakes. Each number indicates a change of 10 times the concentration of the previous value. A pH 6 is 10 times more concentrated than a pH 7, a pH 5 is (10x10) 100 times pH 7 and pH 4 is (10x10x10) 1,000 times pH 7, etc.

WHAT ABOUT CONDENSATE NEUTRALIZERS? Condensate neutralizers are usually not necessary. A condensate neutralizer is easy to make by filling a short length of 2" or 3" PVC pipe with landscape marble chips, capping it and installing it in series with the condensate drain of the equipment. Most commercial neutralizers are off the market because of poor demand for the product. Condensation from the exhaust vent piping and tank internal flue way **must** be allowed to drain. A "blocked flue" indication will often be your first indication that condensate is **not** draining.

Downloaded from www.Manualslib.com manuals search engine

OPERATION

SEQUENCE OF OPERATION



Downloaded from www.Manualslib.com manuals search engine

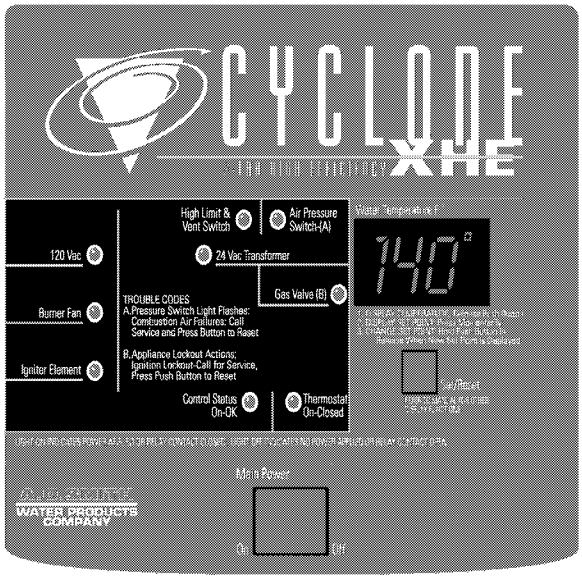
CONTROLS

NORMAL INDICATIONS / READINGS / SETTINGS

During Call for Heat

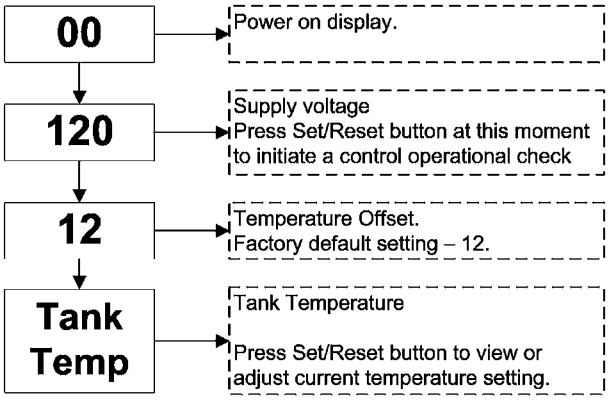
- On/Off switch in the “on” position
- Water Temperature F° — current average tank water temperature displayed
- 120 VAC LED light on
- 24 VAC LED light on
- High Limit/Vent Switch LED light on
- Blower (while blower is running) LED light on
- Air Pressure Switch (while blower is running) LED light on
- Control Status LED light on
- Gas Valve (during ignition period and heating cycle) LED light on

DISPLAY PANEL (CONTROL PANEL)



The water temperature inside the tank must be below the current temperature setting to activate a call for heat. Pressing the Set/Reset button approximately 4 – 6 seconds after powering up the water heater will reveal the current temperature setting. See the instructions below for how to view or change temperature settings.

Power On Display Sequence / Indication



To View Or Change Temperature Settings

Press the Set/Reset button once to view the current temperature setting.

Press and hold the Set/Reset button down to change the current setting.

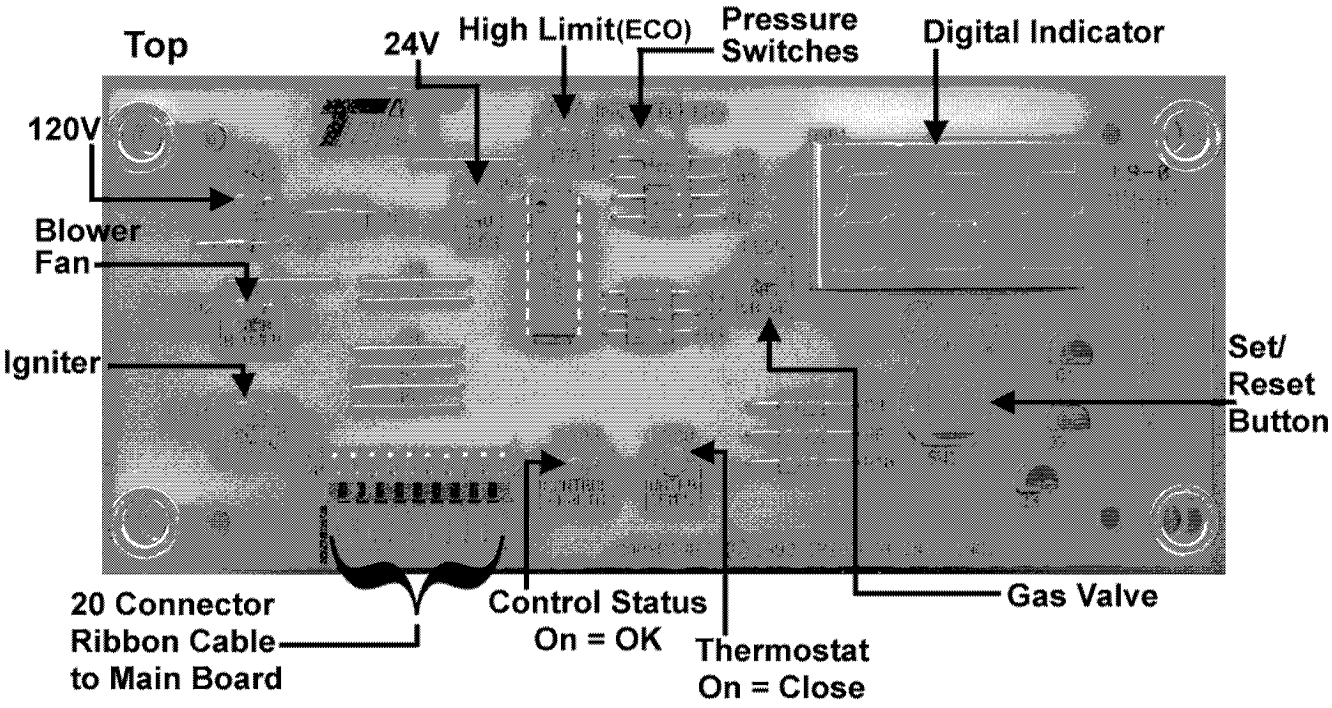
When pressed and held down it will raise/lower the setting, quickly releasing and pressing down/holding again will switch between raising and lowering. When the desired setting is reached release the button.

The control must satisfy a call for heat with the new setting for the new setting to remain in memory. If the water heater does not satisfy a call for heat with the new setting, the new setting is lost and the previous setting remains in effect.

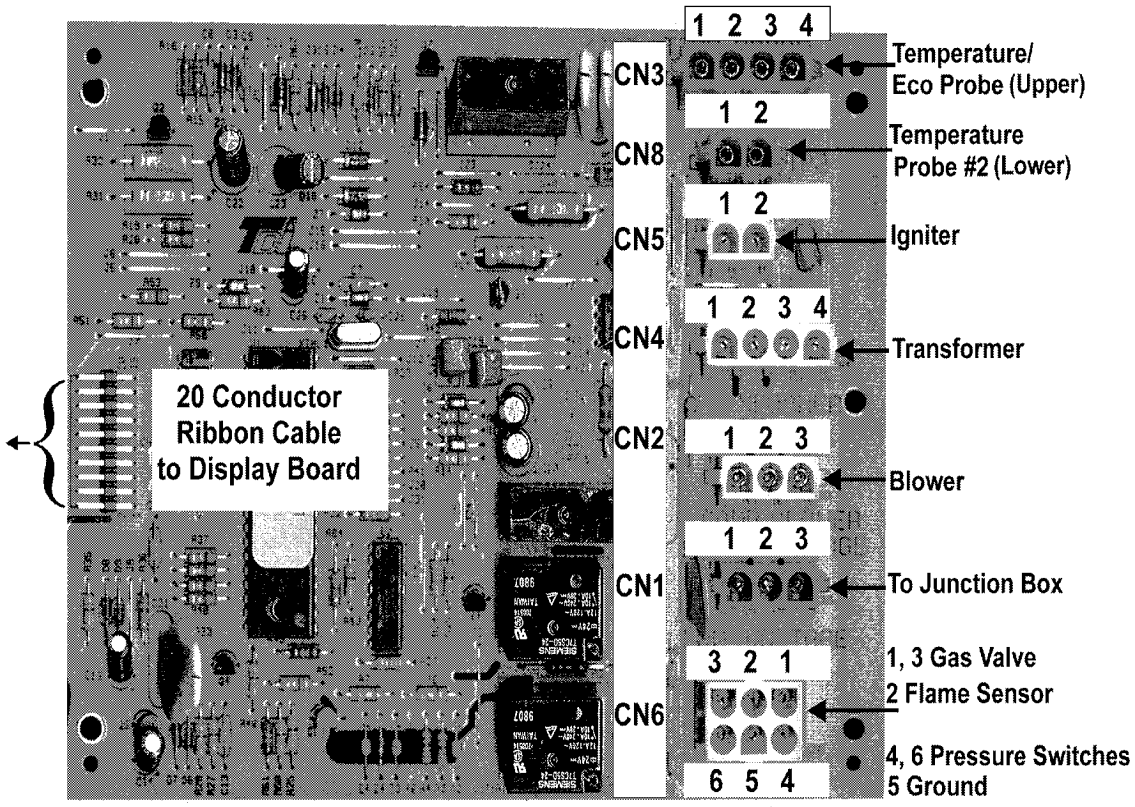
Downloaded from www.Manualslib.com manuals search engine

CIRCUT BOARDS

DISPLAY CIRCUIT BOARD



IGNITION CIRCUIT BOARD



Downloaded from www.Manualslib.com manuals search engine

TROUBLESHOOTING

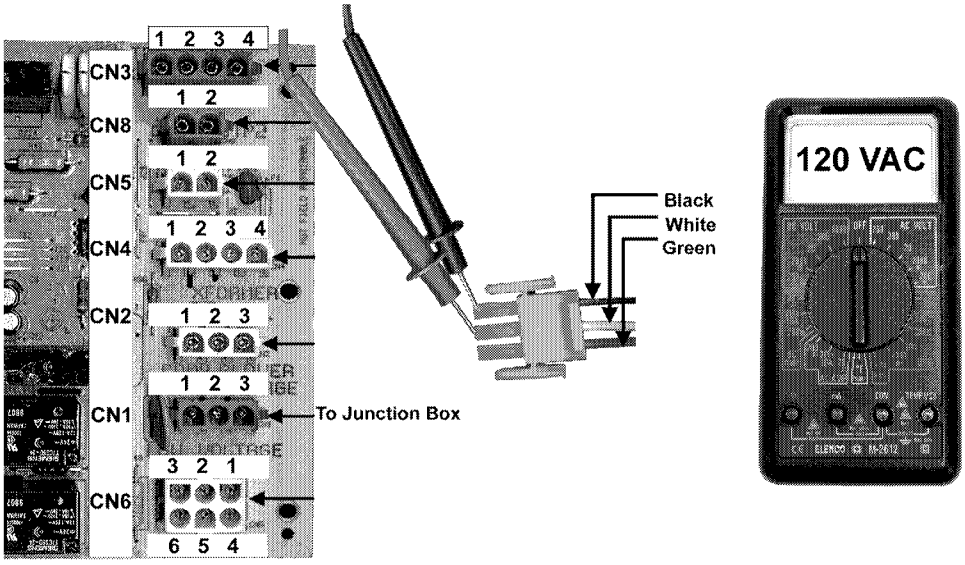
PRE-SERVICE TIPS

CHECK THAT:

- Insure 120 VAC power supply has correct polarity — check neutral (white) wire to ground with volt meter. It should read “0” volts.
- Tank is full of water
- Exhaust and intake vent do not exceed allowable limits
- All plugs into boards are secure
- Condensate hose is drained and open
- Proper (natural or propane) gas is supplied

120 VAC TO CONTROL

STEP 1 120 VAC TO CONTROL BOARD



STEP 1: CHECK FOR 120 VAC TO CONTROL BOARD CN1 TERMINAL.

Condition:

- Disconnect plug from CN1 terminal.
- On/Off switch is on.

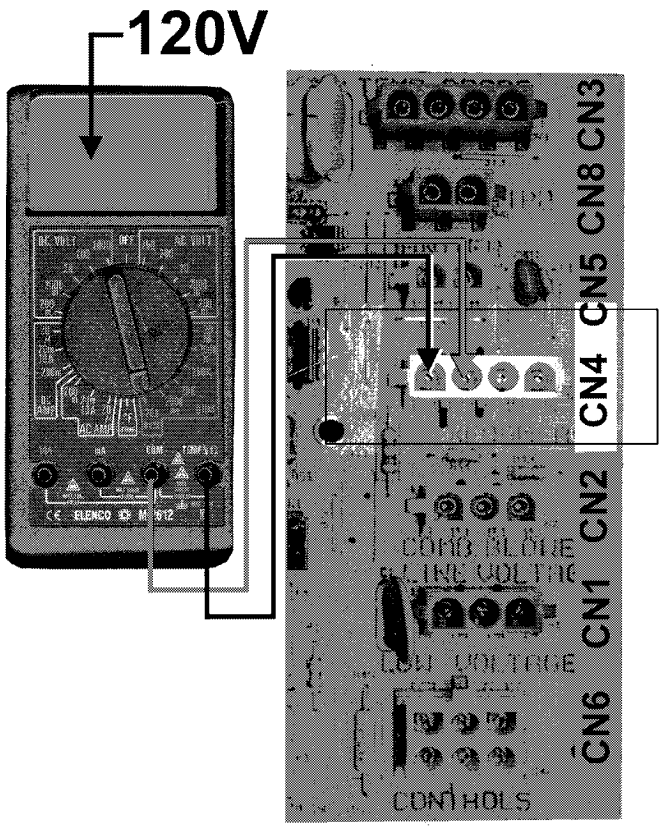
Check for 120 VAC black wire terminal white wire on plug.

IF…	THEN
120 VAC is not present	check On/Off switch, turn switch on, replace On/Off switch if defective, restore power to the water heater.
120 VAC is present	reconnect CN1 plug, continue to Step 2.

Downloaded from www.Manualslib.com manuals search engine

TRANSFORMER

STEP 2	120 VAC TO TRANSFORMER



STEP 2: CHECK FOR 120 VAC TO TRANSFORMER FROM PIN 1 AND 2 ON CONTROL BOARD CN4 TERMINAL.

Condition:

- Disconnect CN4 plug from control board.
- On/Off switch is on.

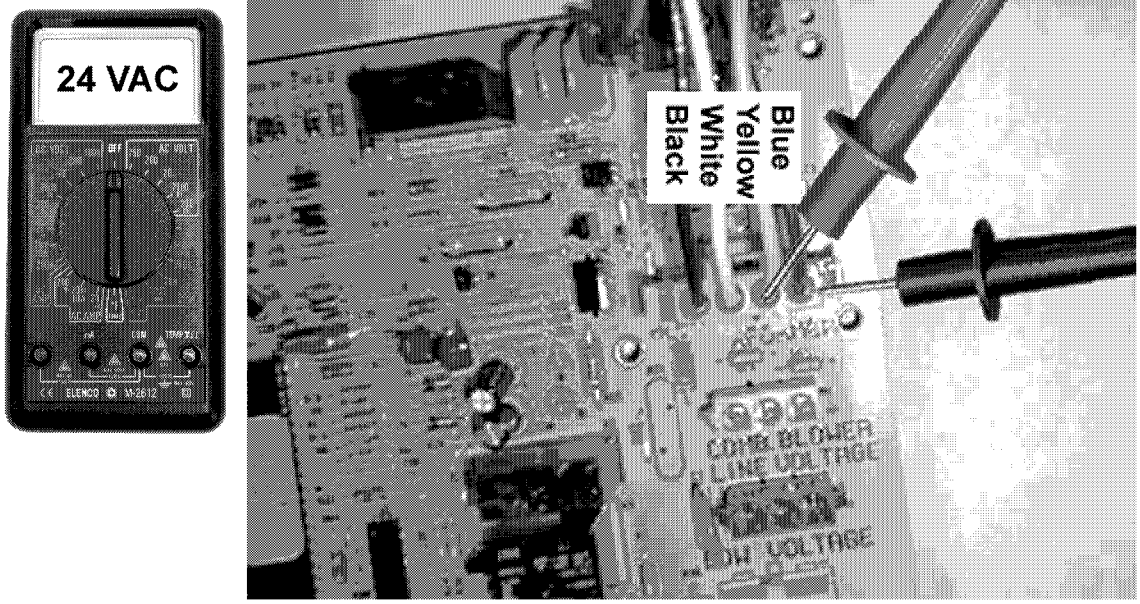
Check for 120 VAC between pin 1 and 2 at CN4 on the control board as illustrated above. Perform this test with the CN4 plug disconnected and the On/Off switch turned on.

IF...	THEN
120 VAC is not present	check CN1 plug connection replace control board if Step 1 has been performed and results were successful.
120 VAC is present	reconnect CN4 plug to control board, continue to Step 3.

Downloaded from www.Manualslib.com manuals search engine

TRANSFORMER (CONTINUED)

STEP 3	24 VAC FROM TRANSFORMER



STEP 3: CHECK FOR 24 VAC AT TRANSFORMER CN4 PLUG ON CONTROL BOARD.

Condition:

- CN4 is plugged into control board.
- On/Off switch is on.

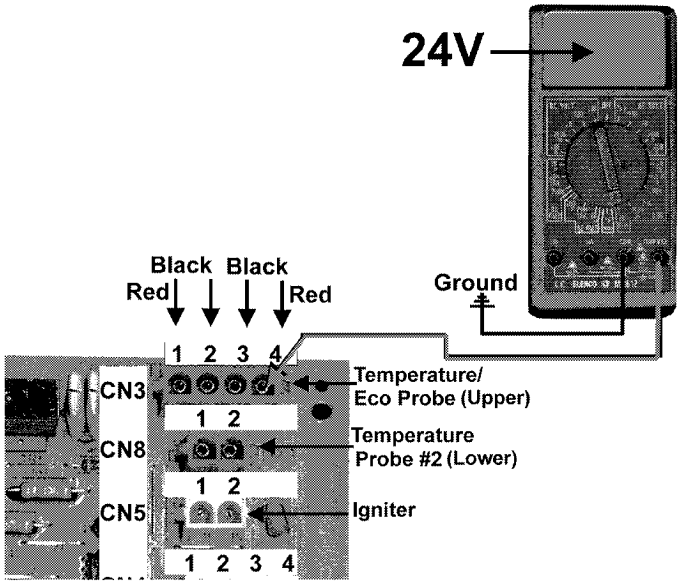
Insert meter probes into back of CN4 plug on pins 3 and 4 (blue and yellow wires) with CN4 plugged in and power on.

IF…	THEN
24 VAC is not present	replace transformer if Steps 1 and 2 were performed and results were successful.
24 VAC is present	continue to Step 4.

Downloaded from www.Manualslib.com manuals search engine

ECO CHECK

STEP 4	24 VAC TO ECO



STEP 4: CHECK FOR 24 VAC BETWEEN PIN 4 ON CONTROL BOARD TERMINAL CN3 AND GROUND.

Condition:

- Disconnect CN3 plug from control board.
- On/Off switch is on.

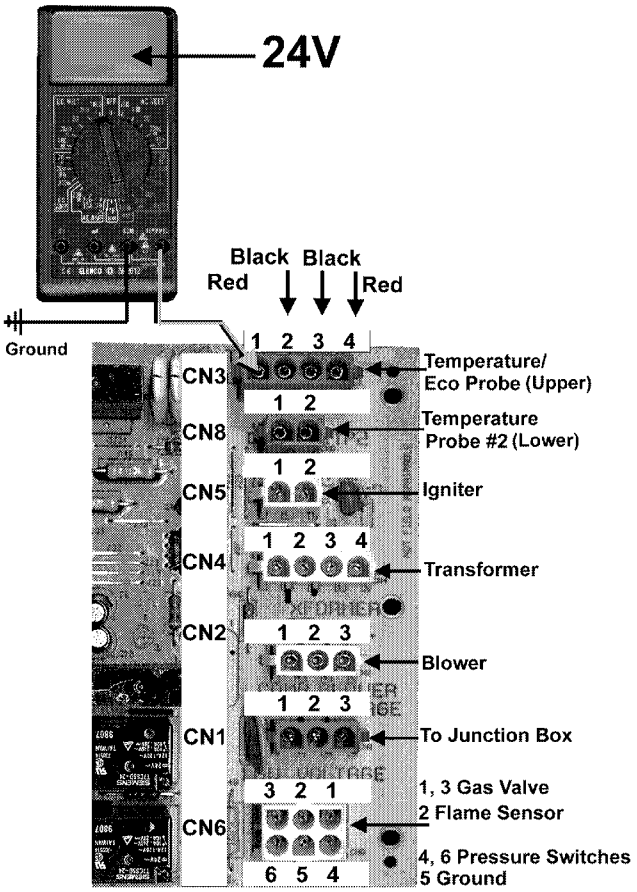
Check for 24 VAC between pin 4 of the CN3 terminal on the control board and ground.

IF…	THEN
24 VAC is not present	replace the control board if Steps 1, 2, and 3 have been performed and the results were successful.
24 VAC is present	continue to Step 5.

Downloaded from www.Manualslib.com manuals search engine

ECO CHECK (CONTINUED)

STEP 5 24 VAC FROM ECO



STEP 5: CHECK FOR 24 VAC BETWEEN PIN 1 ON CN3 PLUG AND GROUND.

Condition:

- Reconnect CN3 plug to control board.
- On/Off switch is on.

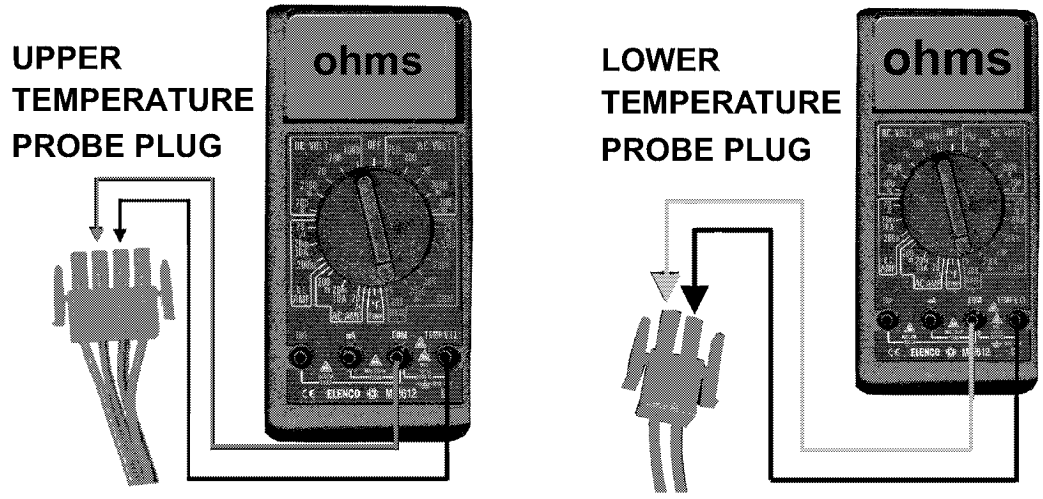
Insert one meter probe into the back of CN3 plug pin 1, check for 24 VAC between here and ground with CN3 plugged in and power on. (See illustration above for pin number locations.)

IF…	THEN
24 VAC is not present	make sure water temperature in tank is below 160° F, press Set/Reset button on display panel, replace upper temperature/ECO probe if tank water temperature is below 160 and Step 4 has been performed and results were successful.
24 VAC is present	continue to Step 6.

Downloaded from www.Manualslib.com manuals search engine

TEMPERATURE PROBE

STEP 6 TEMPERATURE PROBE RESISTANCE



STEP 6: CHECK RESISTANCE OF THERMISTOR IN UPPER AND LOWER TEMPERATURE PROBES.

Condition:

- Disconnect CN3 and CN8 plugs from control board.
- On/Off switch is off.
- Multimeter is set to lowest ohms scale above expected resistance.

Check resistance between black wire connects on CN3 and CN8 plugs as shown in illustration above.

IF...	THEN
ohm reading does not approximately correspond to table at given temperatures	replace temperature probe if thermistor is open. shorted, or resistance value is off significantly.
ohm reading does approximately correspond to table at given temperatures	continue to Step 7.

WATER TEMP		OHMS RESISTANCE
°C	°F	
3 21	40 70	26,435 11,974
37.5 49	100 120	5,862 3,780
54.5 60	130 140	3,066 2,503
71 82	160 180	1,698 1,177

NOTE: The upper and lower temperature probes contain thermistors which are heat sensitive resistors. The control board interprets changes in thermistor resistance as changes in water temperature.

These thermistors are very reliable and should only be replaced when:

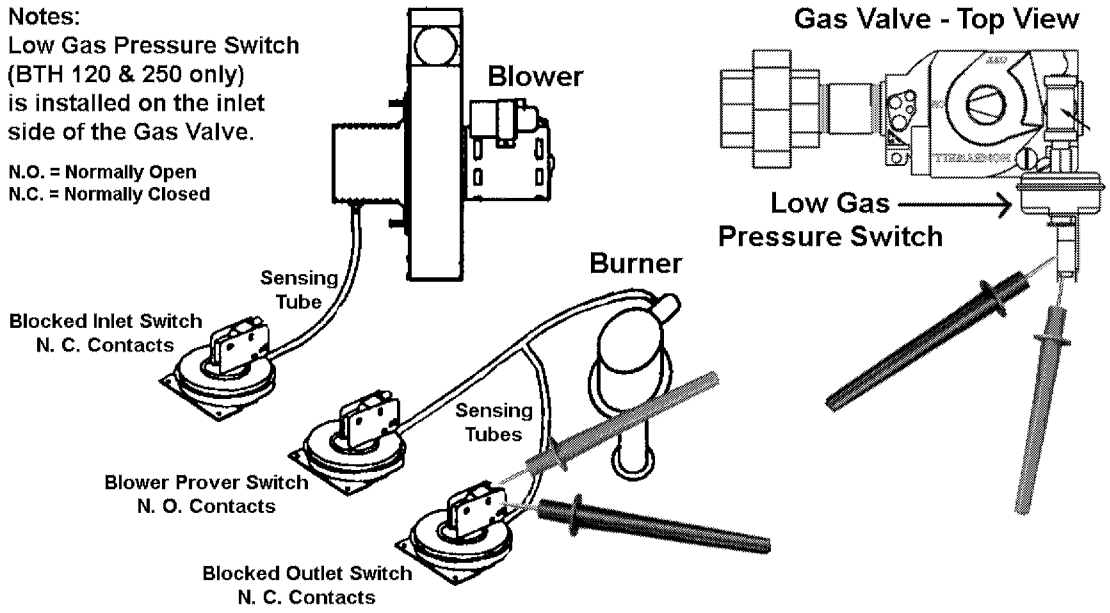
The resistance test indicates an “open” (infinite resistance) or a “direct short” (no resistance) circuit.

The nature of the service problem is temperature control and the resistance readings are significantly off when compared to the values in the table here at the given temperature.

Downloaded from www.Manualslib.com manuals search engine

PRESSURE SWITCH CONTINUITY

STEP 7 PRESSURE SWITCH CONTINUITY TEST



STEP 7: CHECK FOR CONTINUITY BETWEEN PRESSURE SWITCH TERMINALS WITH WIRES REMOVED.

Condition:

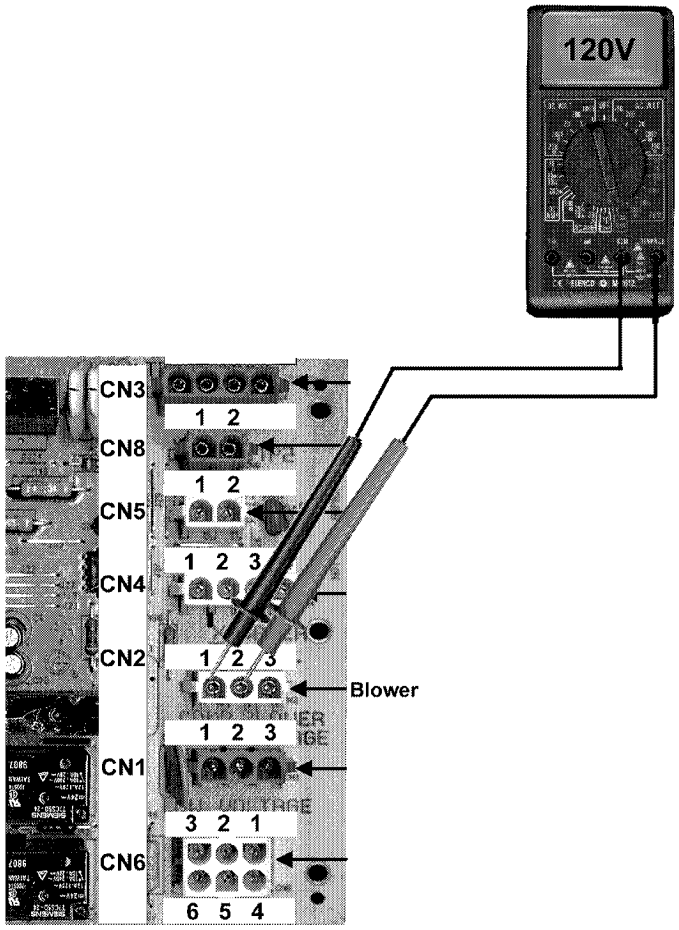
- On/Off switch is off.
- All wires are disconnected from all pressure switches.
- Multimeter is set to lowest ohms scale.

IF…	**THEN**
blocked inlet switch **does not** show continuity	replace switch.
blocked inlet switch **does** show continuity	continue.
blower proving switch **does** show continuity	replace switch.
blower proving switch **does not** show continuity	continue.
low gas pressure switch **does not** show continuity	check for minimum supply gas pressure of **5.0" W.C. natural gas** **9.0" W.C. LP gas** replace switch if gas pressures are above these minimums.
low gas pressure switch **does** show continuity	continue.
blocked outlet pressure switch **does not** show continuity	replace switch.
blocked outlet pressure switch **does** show continuity	reconnect all wires to pressure switches; continue to Step 8A.

Downloaded from www.Manualslib.com manuals search engine

BLOWER

STEP 8A 120 VAC TO BLOWER



STEP 8A: CHECK FOR 120 VAC TO BLOWER FROM CN2 PLUG PIN 1 AND 2.

Condition:

- Reconnect all plugs to control board.
- On/Off switch is on.
- Call for heat is activated.

Insert meter probes into back of CN2 plug on pins 1 and 2 with CN2 plugged in, power on, and a call for heat activated.

IF…	AND	THEN
120 VAC is not present		replace the control board if call for heat is active and Step 7 has been performed and results were successful.
120 VAC is present	blower is not running	BTH 250, 962 & 966 Series only continue to Step 8B all other models — check CN2 plug connection, replace blower.
120 VAC is present	blower is running	BTH 250, 962 & 966 Series only continue to Step 8C all other models — continue to Step 9A.

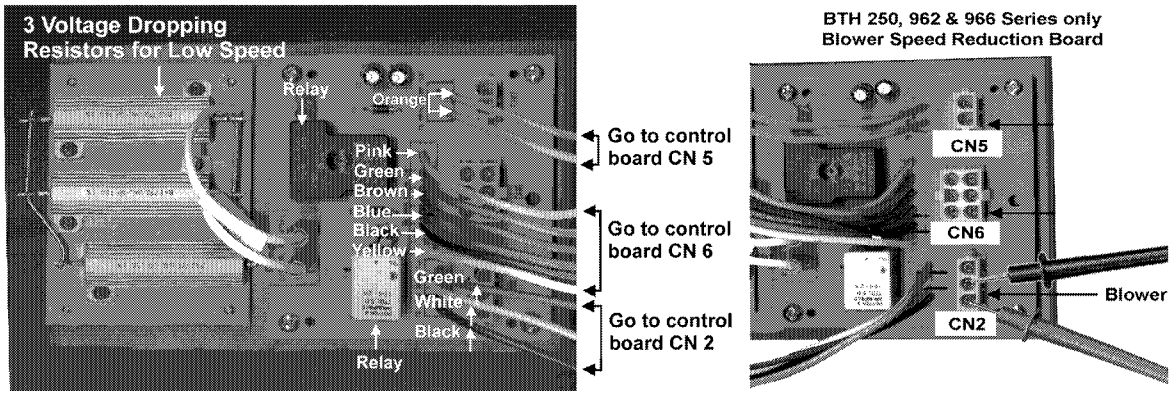
Downloaded from www.Manualslib.com manuals search engine

BLOWER (CONTINUED)

BTH 250, 962 & 966 SERIES ONLY

(Models equipped with blower speed reduction board)

STEP 8B 120 VAC TO BLOWER FROM SPEED REDUCTION BOARD



STEP 8B: CHECK FOR 120 VAC TO BLOWER FROM CN2 PLUG PIN 1 AND 2 ON BLOWER SPEED REDUCTION BOARD.

Condition:

- Reconnect all plugs to control board.
- On/Off switch is on.
- Call for heat is activated.

Insert meter probes into back of CN2 plug on pins 1 and 2 with CN2 plugged into blower speed reduction board. Power should be on with a call for heat activated.

IF…	AND	THEN
120 VAC is not present		check CN2 plug connection, replace blower speed reduction board if Step 8A has been performed and results were successful.
120 VAC is present	blower is not running	check CN2 plug connection, replace the blower.
120 VAC is present	blower is running	continue to Step 8C.

STEP 8C: LISTEN FOR BLOWER TO REDUCE SPEED DURING IGNITOR WARM UP PERIOD.

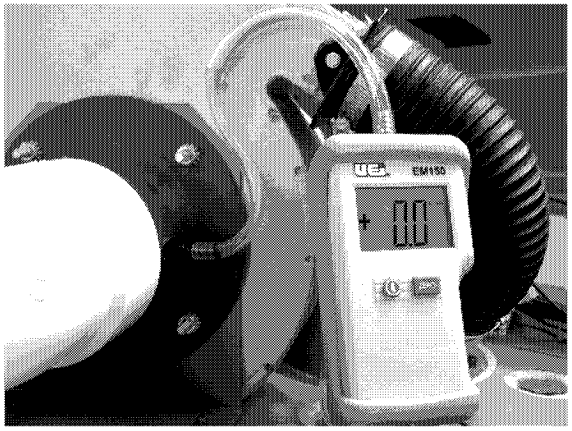
IF…	THEN
blower runs, but does not reduce speed or stops during ignitor warm up period	replace blower speed reduction board.
blower does reduce speed during ignitor warm up period	continue to Step 9A.

Downloaded from www.Manualslib.com manuals search engine

PRESSURE SWITCH PERFORMANCE

STEP 9A TAKE AIR AND GAS PRESSURE READINGS.

Blower prover and blocked outlet pressure



Blower inlet pressure

STEP 9A: CHECK PRESSURE AT SENSING PORTS ON BURNER, BLOWER INLET AND GAS VALVE.

Condition:

- All wires are reconnected to all pressure switches.
- On/Off switch is on.
- Call for heat is activated.
- Blower is running during trial for ignition.

Remove the air pressure sensing tubes from the sensing ports on the blower inlet and the burner. Using a digital manometer take a pressure reading with the blower running during a call for heat at both of these sensing ports. Take a supply gas pressure reading on the inlet side of the gas valve as outlined in Step 13.

Record all 3 pressure readings and have them on hand. Continue to Step 9B.

AMBIENT ROOM AIR PRESSURE

N O T E : One side of the internal diaphragms on these pressure switches are vented to the room atmosphere. Due to this construction a negative or positive room air pressure can cause erratic switch operation and the water heater to shut down. If you suspect a pressure imbalance between the equipment room and the outdoor atmosphere, “zero” or calibrate your digital manometer to the equipment room ambient air pressure. With the manometer still on and calibrated to the equipment room air pressure take the manometer outdoors. If the pressure reading changes significantly you may have a pressure imbalance between the equipment room and the outdoor atmosphere. This pressure imbalance may need to be corrected before the water heater will operate properly.

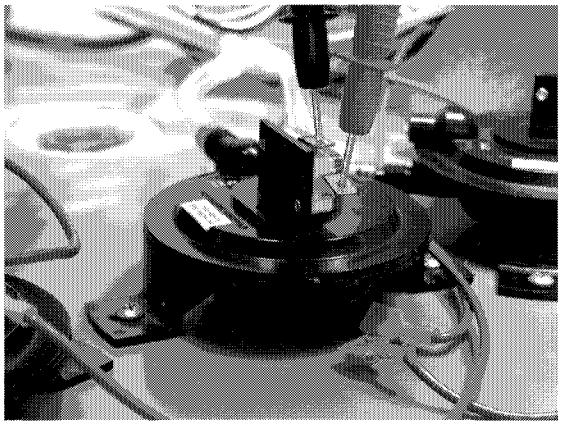
Insure the combustion/make-up air openings into the equipment room are properly sized. Check for leaks in ductwork on any nearby air handling equipment. If there is a kitchen vent hood installed in the building, insure it is properly balanced. Missing or worn fan belts on make up air fans to vent hoods can cause negative air pressure throughout the building.

Direct vent installations DO NOT eliminate this potential problem.

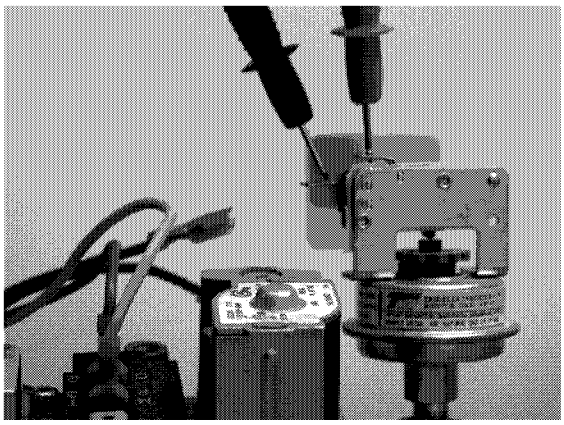
Downloaded from www.Manualslib.com manuals search engine

PRESSURE SWITCH PERFORMANCE (CONTINUED)

STEP 9B PRESSURE SWITCH CONTINUITY TEST — OPERATIONAL



Air pressure switches



Low gas pressure switch

STEP 9B: CHECK FOR CONTINUITY BETWEEN PRESSURE SWITCH TERMINALS WITH WIRES REMOVED AND BLOWER RUNNING.

Condition:

- All wires are disconnected from all pressure switches — ends are taped off.
- On/Off switch is on.
- Call for heat is activated.
- Blower is running during trial for ignition.
- Multimeter is set to lowest ohms scale.

The wires disconnected are energized with 24 VAC from the control board. Do not allow these wires to touch ground — use electrical tape to insulate wire connects during this test.

Check for continuity with an ohm meter between terminals on all pressure switches with the wires removed and the blower running during a trial for ignition. Restart the water heater as needed.

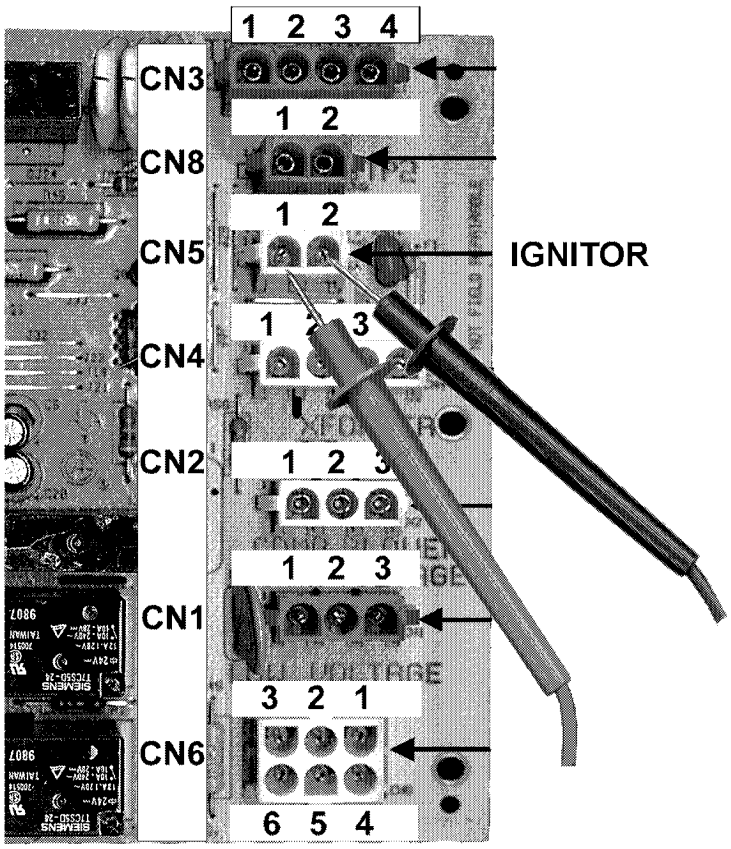
The pressure switches are wired together in a “series” circuit. For the water heater to continue to fire and satisfy a call for heat the control board must sense a closed pressure switch circuit.

IF…	THEN
continuity is not present between terminals on one or more pressure switches — the switch contacts are open. compare the pressure reading recorded in Step 9A to the value given for that switch in the table on page 36. compare to value for correct Model and Series number in table.	if the pressure recorded in Step 9A is within the value shown in the table for the switch contacts to remain closed — replace the pressure switch. if the pressure recorded in Step 9A is not within the value shown in the table for the switch contacts to remain closed — check for/ clear any restrictions in the vent and/or air intake piping, check for an excessive number of elbows or equivalent feet of pipe used in the vent and/or air intake piping. check for/restore minimum supply gas pressure — Step13.
continuity is present.	continue to Step 10A.

Downloaded from www.Manualslib.com manuals search engine

120 VAC TO IGNITOR

STEP 10A 120 VAC TO IGNITOR



STEP 10A: CHECK FOR 120 VAC TO IGNITOR FROM PIN 1 AND 2 ON CONTROL BOARD TERMINAL CN5.

Condition:

- Disconnect CN5 plug from control board.
- On/Off switch is on.
- Call for heat is activated.
- Perform test during ignitor warm up period.

IF...	THEN
120 VAC is not present	replace the control board if Steps 7 through 9B have been performed and results were successful.
120 VAC is present on — BTH 250, 962 & 966 Series	continue to Step 10B.
120 VAC is present on — all other models	continue to Step 11.

Downloaded from www.Manualslib.com manuals search engine

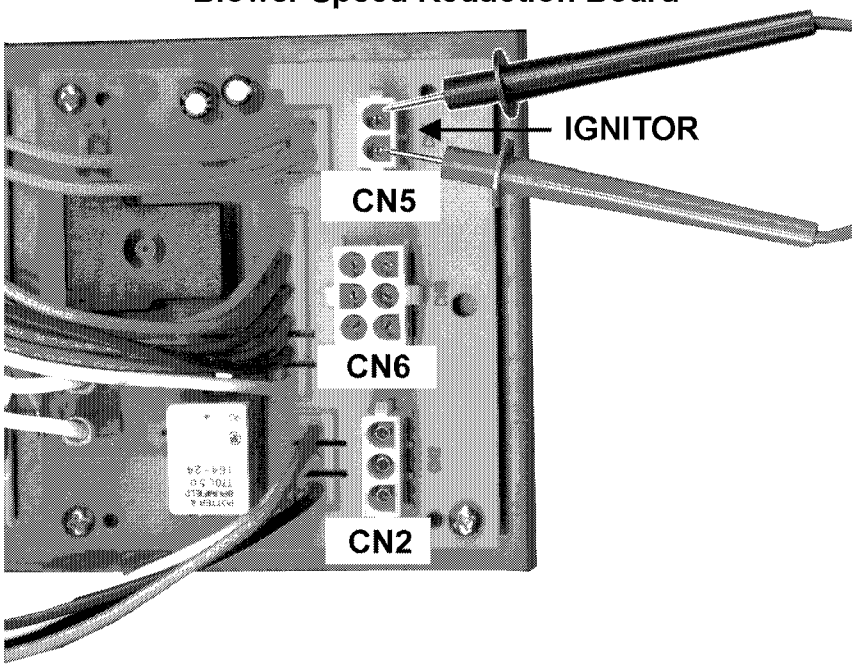
120 VAC TO IGNITOR (CONTINUED)

BTH 250, 962 & 966 SERIES ONLY

(Models equipped with blower speed reduction board)

STEP 10B	120 VAC TO IGNITOR FROM SPEED REDUCTION BOARD

BTH 250, 962 & 966 Series only
Blower Speed Reduction Board



STEP 10B: CHECK FOR 120 VAC TO IGNITOR FROM PIN 1 AND 2 ON BLOWER SPEED REDUCTION BOARD CN5 TERMINAL.

Condition:

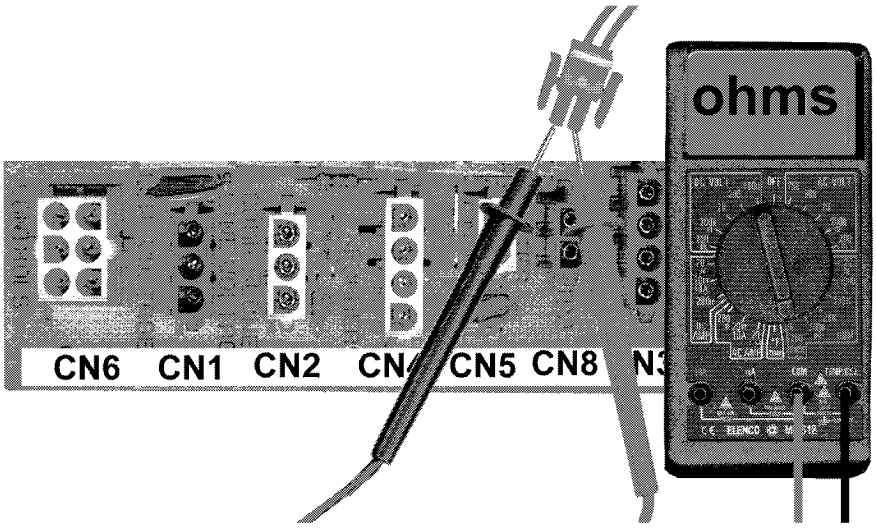
- Reconnect CN5 plug on control board.
- Disconnect CN5 plug from blower speed reduction board.
- On/Off switch is on.
- Call for heat is activated.
- Perform test during ignitor warm up period — blower should be running at reduced speed.

IF...	THEN
120 VAC is not present	replace the blower speed reduction board if Step 10A has been performed and results were successful.
120 VAC is present	continue to Step 11.

Downloaded from www.Manualslib.com manuals search engine

IGNITOR RESISTANCE

STEP 11	IGNITOR RESISTANCE CHECK



STEP 11: CHECK RESISTANCE BETWEEN TWO WIRE CONNECTS AT CN5 IGNITOR PLUG END.

Condition:

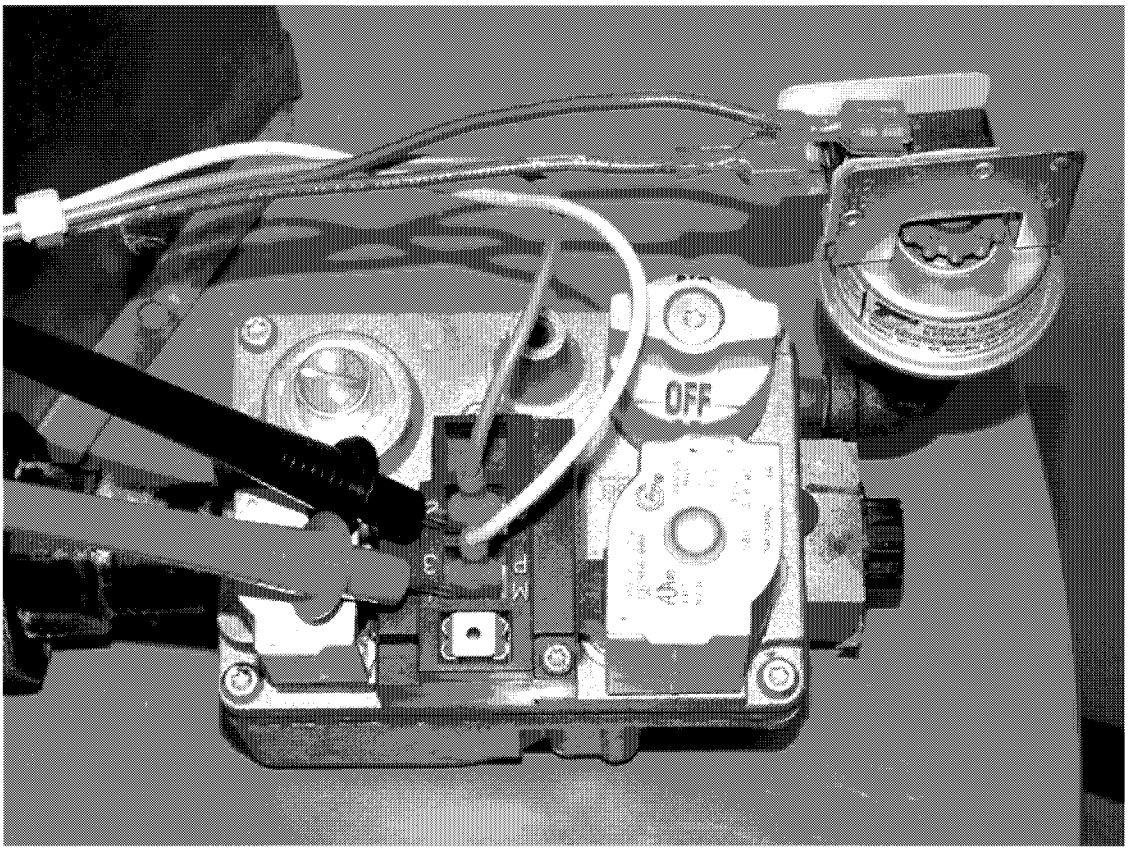
- On/Off switch is off.
- Disconnect CN5 ignitor plug from circuit board.
- Multimeter is set to lowest ohms scale above 300 ohms.

IF…	THEN
ohms reading taken is not between 50 – 300 ohms	replace the ignitor.
ohms reading taken is between 50 – 300 ohms	reconnect CN5 plug, continue to Step 12.

Downloaded from www.Manualslib.com manuals search engine

GAS VALVE TEST

STEP 12 24 VAC TO GAS VALVE



STEP 12: CHECK FOR 24 VAC TO GAS VALVE DURING TRIAL FOR IGNITION.

Condition:

- All wires are reconnected.
- On/Off switch is on.
- Call for heat is activated.
- Perform test at end of ignitor warm up period.

Touch meter probes to wiring terminals on gas valve with wires from control board still connected during the ignitor warm up period.

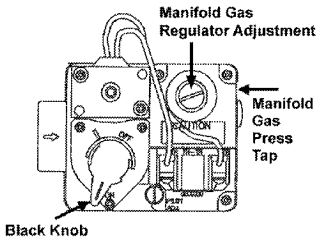
IF...	AND	THEN
24 VAC is not present to gas valve		replace control board if Step 9A and 9B have been performed and results were successful.
24 VAC is present	gas does not flow to burner	check for/restore supply gas; check for/clear any restriction in the gas train; replace the gas valve if the valve will not open with 24 VAC applied.
24 VAC is present	gas does flow to burner	continue to Step 13.

Downloaded from www.Manualslib.com manuals search engine

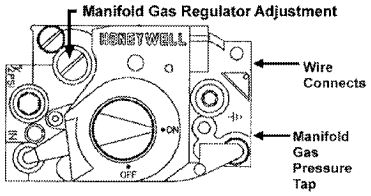
GAS PRESSURE CHECK

STEP 13 SUPPLY GAS PRESSURE TEST

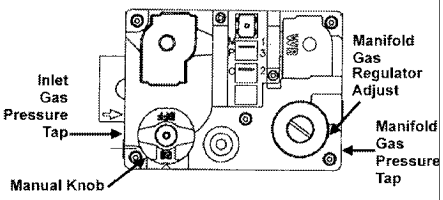
BTH 150, 199 Propane BTH 250 Natural Gas Valve



BTH 150, 199 Natural Gas Valve



BTH 120 Natural/Propane Gas Valve



STEP 13: CHECK AND ADJUST SUPPLY GAS PRESSURE.

Attach manometer or gas pressure gauge to pressure tap on gas valve or use adapter to check pressure ahead of valve as near as possible to valve. All appliances being served by this gas supply line should be operating.

IF...	THEN
supply gas pressure is not between 5.0 and 14" W.C. natural gas or 11.0 and 14" W.C. propane	adjust supply gas pressure (Recommended supply minimum is 7.0" W.C. for natural gas models)
proper supply gas pressure is present	continue to Step 14.

STEP 14 MANIFOLD GAS PRESSURE TEST

STEP 14: CHECK AND ADJUST MANIFOLD GAS PRESSURE.

IF...	THEN
manifold gas pressure is not: natural gas models 3.5" W.C. ± 0.3" – BTH 155 & 199 4.0" W.C. ± 0.3" – BTH 120 & 250 propane gas models 10.0" W.C. ± 0.3" – all propane gas models.	adjust manifold gas pressure to values given for model and fuel type (within 0.3" W.C. tolerance) if manifold gas pressure cannot be adjusted to maintain values given (within 0.3" W.C. tolerance) replace gas valve.
manifold gas pressure is within tolerances given above	ignition should occur.

Downloaded from www.Manualslib.com manuals search engine

COMPONENT INFORMATION

FLAME SENSING ROD				
AOS PART NUMBER	**FLAME SENSING CURRENT**		**COMMENTS**	
192478	0.7 Micro Amp (µ)		BTH 120 - 250	
HOT SURFACE IGNITOR (HSI)				
AOS PART NUMBER	**VOLTAGE**	**AMP**	**OHMS COLD**	**COMMENTS**
192638	120 VAC	1.0	50 – 300	BTH 120 – 250

ORIFICE TABLE

ORIFICE TABLE				
BTH MODEL	**MAIN BURNER ORIFICE NO.**	**MAIN ORIFICE SIZE INCHES**	**AIR ORIFICES PT. NO.**	**AIR ORIFICE SIZE — INCHES**
120	192477-3	0.204	192450-3	0.788
150	192477-1	0.235	192450-1	0.875
199	192477-0	0.304	192450-0	1.031
250	192477-2	0.360	192450-2	1.196
120 Prop	192477-6	0.125”	192450-5**	0.872
150 Prop	192477-5	0.141”	192450-5**	0.872
199 Prop	192477-4	0.166”	192450-4**	1.150

*-4 and -5 Red plated for Propane.

** -4 and -5 stamped with “P” for Propane

N O T E : Hex head of main burner orifice is upstream end — gas flows out of tapered end.

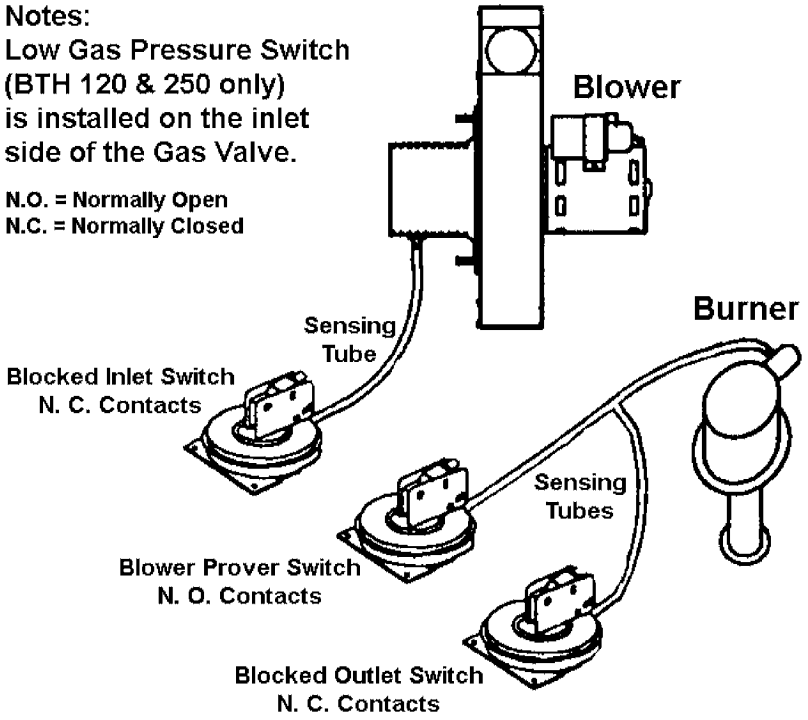
Downloaded from www.Manualslib.com manuals search engine

PRESSURE SWTCHES

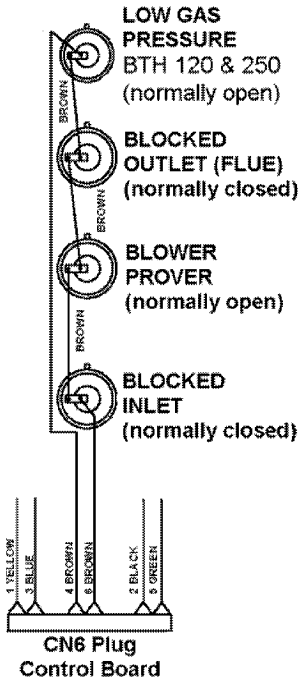
PRESSURE SWITCH LAYOUT

Notes:
Low Gas Pressure Switch
(BTH 120 & 250 only)
is installed on the inlet
side of the Gas Valve.

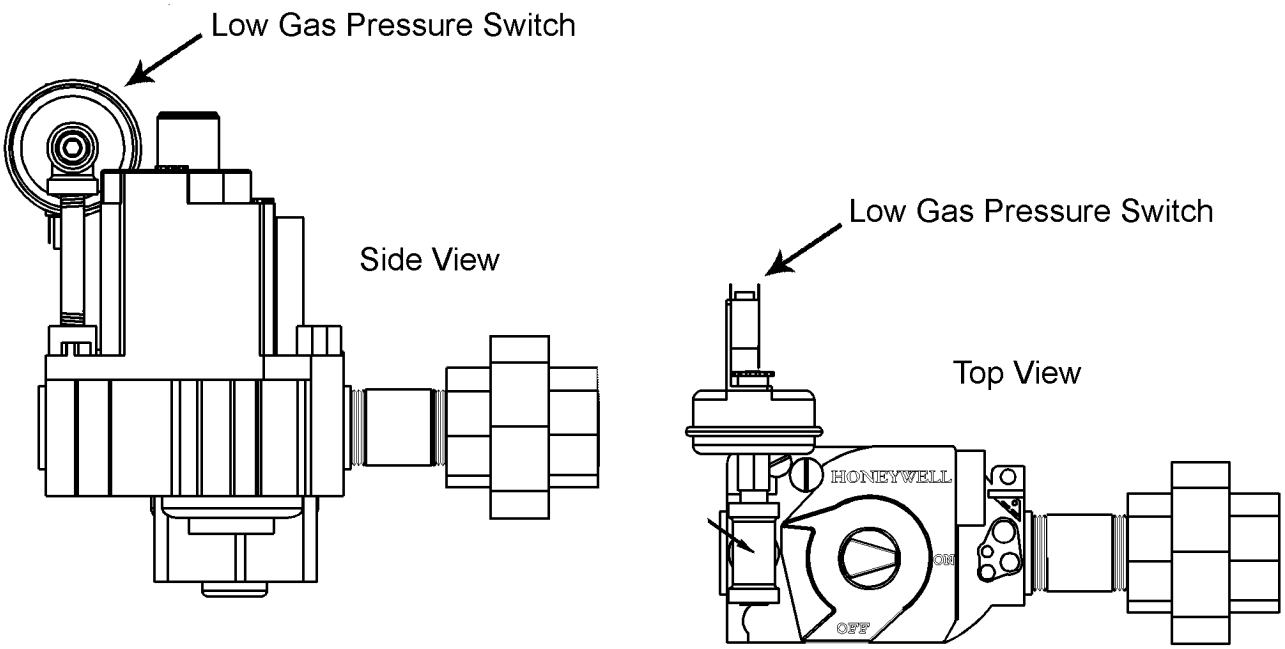
N.O. = Normally Open
N.C. = Normally Closed



PRESSURE SWITCH WIRING



GAS VALVE



Downloaded from www.Manualslib.com manuals search engine

PRESSURE SWITCHES (CONTINUED)

PRESSURE SWITCHES PART NUMBER / ACTIVATION PRESSURE†					
Model	**Series**	**Blocked Inlet Normally Closed Opens on a fall**	**Blower Prover Normally Open Closes on a rise**	**Low Gas Pressure Normally Open Closes on a rise**	**Blocked Outlet Normally Closed Opens on a rise**
BTH 120	**966**	193293-000 / -1.00”	193295-000 / +0.45”	191149-001 / +5.00”	193294-000 / +2.00”
	967	193356-000 / -2.00”	193295-000 / +0.45”	191149-004 / +9.00”	193357-000 / +4.00”
	970	193293-000 / -1.00”	194706-000 / +1.00”	191149-005 / +5.20”	193294-000 / +2.00”
	971	193356-000 / -2.00”	194706-000 / +1.00”	191149-004 / +9.00”	193357-000 / +4.00”
	973	193356-000 / -2.00”	194706-000 / +1.00”	191149-004 / +9.00”	193357-000 / +4.00”
BTH 150	**960**	N/A	192811-000 / +4.20”	N/A	192810-000 / +4.35”
	962	192882-000 / -0.75”	193221-000 / +0.45”	N/A	192878-000 / +2.53”
	966	193363-000 / -0.76”	193295-000 / +0.45”	N/A	193362-000 / +2.60”
	967	193355-000 / -1.80”	193295-000 / +0.45”	N/A	193357-000 / +4.00”
	970	193363-000 / -0.76”	194706-000 / +1.00”	N/A	193362-000 / +2.60”
	971	193355-000 / -1.80”	194706-000 / +1.00”	N/A	193357-000 / +4.00”
	973	193355-000 / -1.80”	194706-000 / +1.00”	N/A	193357-000 / +4.00”
BTH 199	**960**	N/A	192811-000 / +4.20”	N/A	192810-000 / +4.35”
	962	192882-000 / -0.75”	193221-000 / +0.45”	N/A	192878-000 / +2.53”
	966	193363-000 / -0.76”	193295-000 / +0.45”	N/A	193364-000 / +2.87”
	967	193356-000 / -2.00”	193295-000 / +0.45”	N/A	193357-000 / +4.00”
	970	193363-000 / -0.76”	194706-000 / +1.00”	N/A	193364-000 / +2.87”
	971	193356-000 / -2.00”	194706-000 / +1.00”	N/A	193357-000 / +4.00”
	973	193356-000 / -2.00”	194706-000 / +1.00”	N/A	193357-000 / +4.00”
BTH 250	**962**	192947-000 / -0.77”	193221-000 / +0.45”	193222-000 / +4.75”	192946-000 / +4.16”
	966	193361-000 / -0.77”	193295-000 / +0.45”	191149-001 / +5.00”	193357-000 / +4.00”
	970	193361-000 / -0.77”	194706-000 / +1.00”	191149-005 / +5.20”	193357-000 / +4.00”

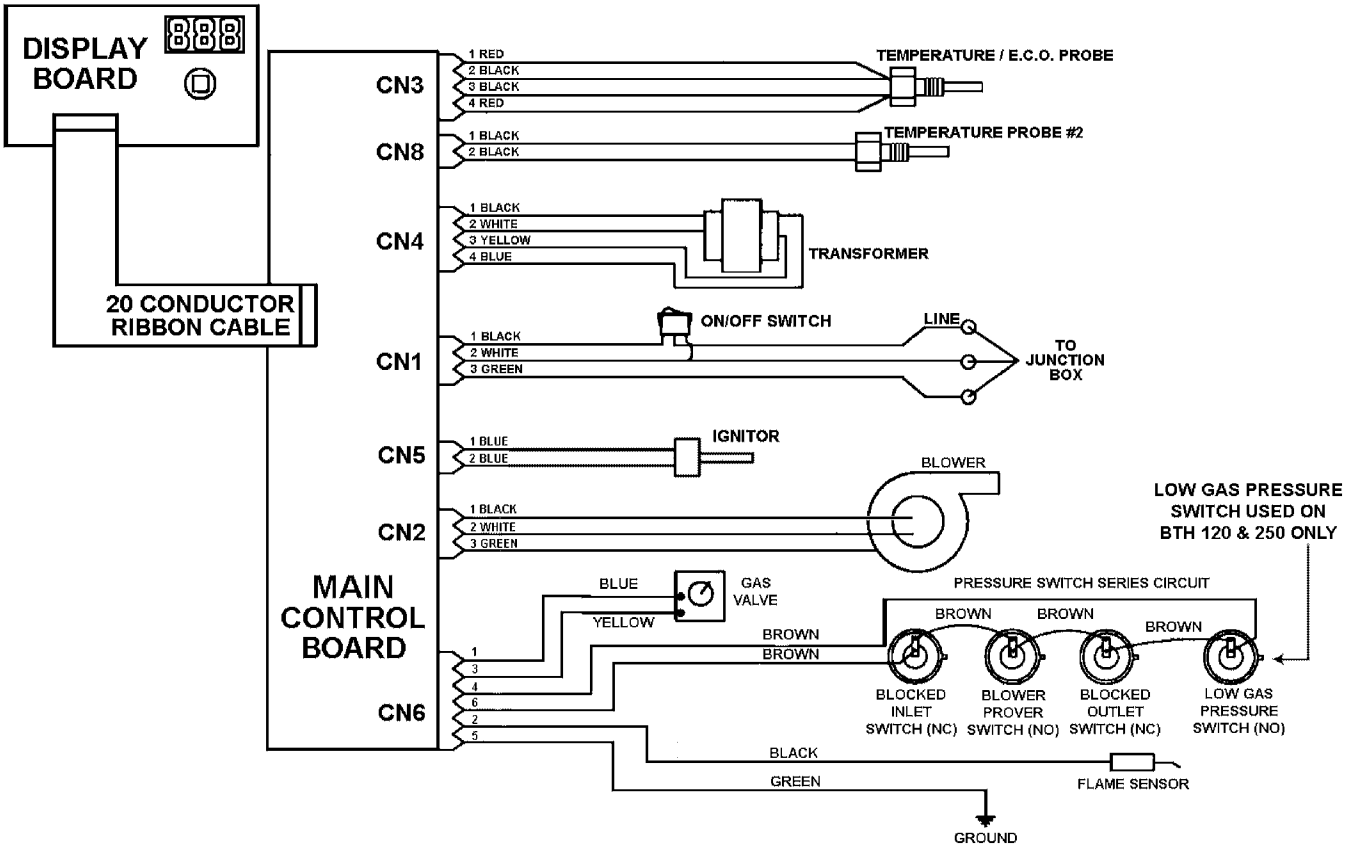
†. Pressure values are given in inches of water column pressure (“W.C.).

Negative pressure values in this table are preceded by a “-” minus sign and indicate pressure below atmospheric; in a vacuum. Positive pressures are preceded by a “+” plus sign and indicate pressure above atmospheric.

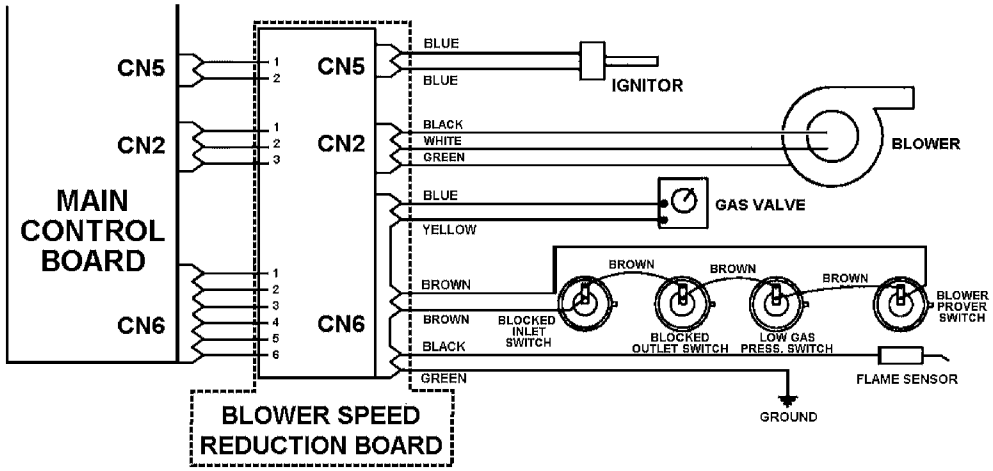
Downloaded from www.Manualslib.com manuals search engine

WIRING DIAGRAMS

BTH 120 - 199 / ALL SERIES
BTH 250 / 970 SERIES
(without blower speed reduction)



DETAIL BTH 250
962 & 966 SERIES ONLY
(with blower speed reduction)



Downloaded from www.Manualslib.com manuals search engine

SERVICE AIDS

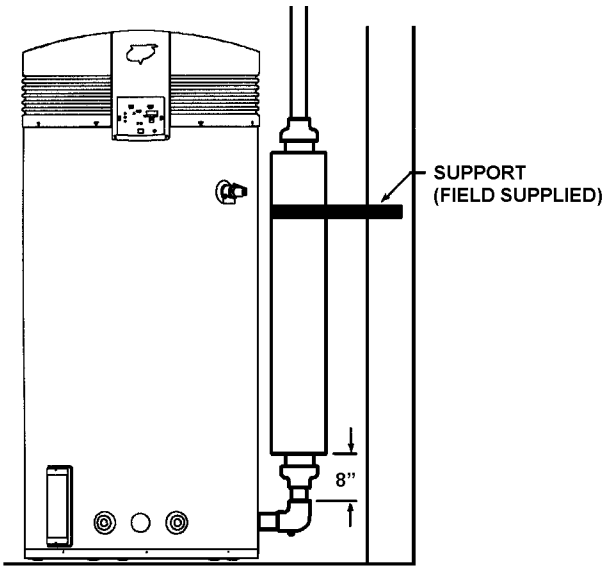
1. This type product is **polarity sensitive**. Be certain that your electrical supply wire neutral has no voltage.
2. This unit will produce condensation — quite heavily at times. The outlet drain hose **must be allowed to drain**. Exhaust Vent piping must also drain condensate. Code 11 error would imply that these must be checked.
3. If the unit is located in a cold climate, take steps to ensure that exhaust vapors are not pulled into the air intake. Terminate both pipes on direct vent installations in the same area, but **maximize the distance** between them.
4. Do **not** combine vent these units.
5. Pushing the reset button at random times may alter setting of the control. Note the sequence of operation comments on when to push this button.
6. If you make a setting change, **cycle the heater** with this new setting to lock it into memory.
7. The first items to check on a service call

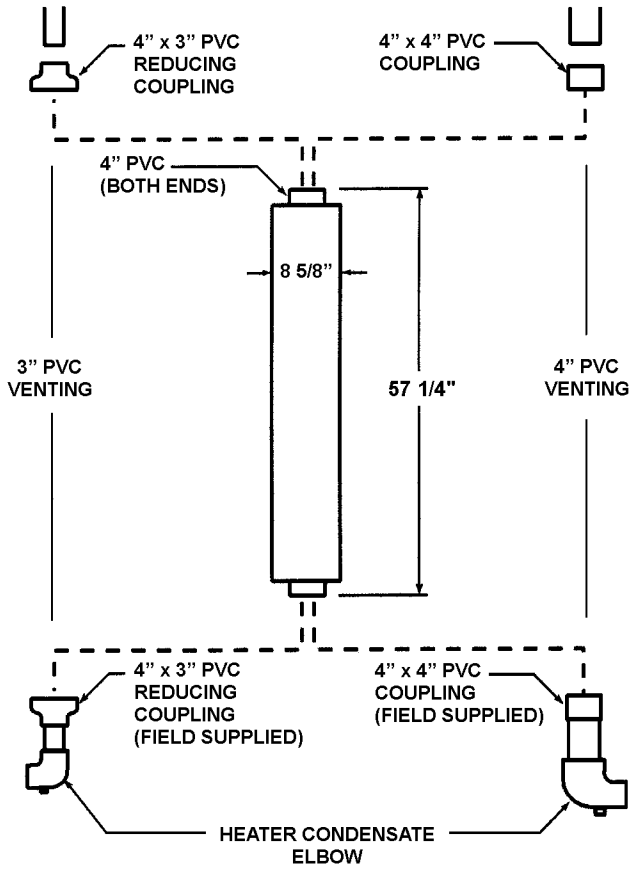
   a. Correct venting installation

   b. Drainage of condensate from hose and exhaust vent pipe
8. BTH models are certified to 6.800 ft. above sea level with the standard orifice — air and gas.
9. The temperature display board indicates **average** tank water temperature. If one tank sensor is “open”, the indicator will display the active sensor temperature. (Because the top tank sensor also contains the high limit-24V-sensor, disconnecting this from the control board results in an error code (04).)
10. Temperature and pressure relief valve operation. **Weeping** usually indicates thermal expansion. **Large volume** discharge usually indicates excessively hot water operation.
11. BTH models are well within decimal level limits, but if you desire to lower the installation level approximately 6 decibels a muffler (AOS No. 195334) may be installed in the exhaust vent.

Downloaded from www.Manualslib.com manuals search engine

BTH MUFFLER





NOTES:

1. Install muffler in vertical position only.
2. Muffler must be a **minimum** of 8" from top of condensate elbow.
3. The muffler inlet and outlet are 4" PVC. If venting with a 4" PVC, a 4" x 4" PVC coupling (field supplied) must be cemented to each end of the muffler. If venting with 3" PVC, a 4" x 3" PVC reducing coupling (field supplied) must be cemented to each end of muffler (see illustration above.)
4. Cement muffler into a location using ASTM D-2564 grade cement.
5. Secure muffler to suitable structure.
6. Operate heater through 1 heat cycle to ensure there are no exhaust leaks and there is no obstruction of exhaust flow.

Downloaded from www.Manualslib.com manuals search engine

QUESTIONS AND ANSWERS

Q. How much electrical power is required for a BTH water heater?

A. The BTH models draw approximately 5.0 Amps Max.

Q. When should BTH's be delimed?

A. Many variables affect the lime build up process including:

- *Water temperature* — the amount of lime accumulation during the same period of time will be nearly 2 times great if water is stored at 140 degrees F than at 120 degrees F. A 180° setting may accumulate seven times more lime — in a period of time — than at 140° setting.
- *Volume of water* — the more gallons flowing through the BTH, the more rapid the accumulation.
- *Hardness* — the harder the water the quicker lime build up occurs. 1 to 3.5 grains per gallons is "soft", 3.5 to 7 grains per gallon is "moderate", 7 to 10.5 grains per gallons is "hard" and 10.5+ grains per gallon is "very hard". (An aspirin is about 5 grains. One grain is equal to 17.1 parts per million.)

A. Deliming should be done when a slight rumbling or popping sound is detected when the main burner is on. Check for accumulation through the clean-out opening.

Q. What effect will lime build-up have on the BTH water heater?

A. One eighth inch of scale buildup on the heat exchanger may reduce efficiency as much as 22%; a ¼ inch buildup, as much as 38%.
Less efficient heat transfer means more heat exchanger expansion/contraction stress and premature leakage.
Because the heat transfer to the water is made through a (relatively) small diameter, coil type exchanger tube, expansion and contraction as well as the shape of the exchanger greatly reduces buildup on the heat transfer surface. The bottom of the tank should be checked for dislodged accumulation.

Q. Anode rods (4) provide additional protection against corrosion. When should these be replaced?

A. When large gauges or pits appear in the anodes, replace them.

Q. How often should the anodes be inspected?

A. Approximately every six months.

Downloaded from www.Manualslib.com manuals search engine

ERROR CODES

CODE	INDICATION
00	This is **normal operation**, 00 is displayed each time the heater is powered up.
01	Indicates the pressure switch circuit was not open during the prediagnostic system check when the proper state of the Draft Prover Switches are verified. The Blower Prover Switch is normally open, the circuit should therefore be open during the prediagnostic system check at the beginning of each cycle. Check Blower Proving Switch for continuity with the blower off, there should be no continuity, check pressure switch wiring.
02	Indicates the heater **failed to light after 3 trials**. Check ignitor, gas pressure, blower speed reduction on BTH 250.
04	Indicates **the ECO is open**. Check water temperature in tank, ECO will open at 202° F and can be reset below 160° F.
05	Indicates a **Temperature Probe is open**. Check both probes for proper resistance and continuity.
11	Indicates the **Pressure Switch Circuit did not close** after blower was energized. Check normally open Blower Prover Switch operation, check normally closed Blocked Outlet, Inlet, and Low Gas pressure (BTH 120 and 250 only) to ensure they remain closed. Check for blocked vent pipe (s) or if equivalent feet venting limits have been exceeded.
15	Indicates **temperature** sensed by probe(s) is **out of bounds**, reading is **less than 30° F**. Check resistance of temp probes, check water temperature in tank.
22	Indicates **Ignition Relay failure**. Should be off and it is on. Try resetting, turn power off and on, if code remains, replace board.
25	Indicates **temperature** sensed by probe(s) is **out of bounds**. Reading is more than 220° F. Check resistance of temp probes, check water temperature.
CODE #S ABOVE 199	**Internal software or hardware errors**, electrical line noise can cause erratic operation and these error codes. Try adding a **"line filter"** (available from electrical suppliers) to the 120 VAC power supply. If these errors codes persist or the control cannot be reset, replace the control board.

All these errors cause a "soft" lockout with the exception of 04 - ECO, which is a "hard" lockout. Soft lockouts will reset automatically after 60 minutes or if the reset button is pushed at any time. The ECO lockout, error code 04 will have to be manually reset by pushing the rest button after water in the tank has cooled below 160° F.

Downloaded from www.Manualslib.com manuals search engine

SERVICE CHECKLIST

This is not intended to be and all-inclusive list of the problem that the Service Agent may encounter. Any item checked "no" on this list should be thoroughly investigated and corrective action taken, if required.

SERVICE AGENT: _____ INSTALLATION DATE: _____
MODEL NUMBER: _____ SERVICE DATE: _____
SERIAL NUMBER: _____ LOCATION ADDRESS: _____
PHONE ( ) _____ - _____

GAS TYPE — CHECK ONE
NATURAL _____
PROPANE _____
PROPER GAS VALUE VERIFIED YES _____ NO _____

I. CHECK CLEARANCE (CIRCLE ANSWER)
- A. Are exterior clearances adequate? _____ yes no
- B. Are interior clearances adequate? _____ yes no
- Comments: _____

II. CHECK MAKEUP AIR REQUIREMENTS
- A. Is the quality of make-up air adequate? _____ yes no
  - Comments: _____
- B. Is the quantity of make-up air adequate? _____ yes no
  - Comments: _____

III. GAS PRESSURE (FILL IN BLANK) — ALL UNITS ON.
- A. Supply gas pressure __ inches of W.C. (flowing)
- B. Manifold gas pressure (main burner) __ inches of W.C. (flowing)
- Comments: _____

IV. VENTING (CHECK)
- A. Acceptable equivalent footage _____ yes no
- B. Proper material _____ yes no
- C. Proper exterior installation _____ yes no
- D. Condensate will drain _____ yes no
- Comments: _____

V. WATER PIPING
- Is the system properly sized? _____ yes no
- Is the system properly installed? _____ yes no
- Are there any water leaks? _____ yes no
- Does the installation have a recirculating system? _____ yes no
- If so, is it operational? _____ yes no

VI. SAFETY
- A. Air
  - If exhaust is blocked will unit lockout? _____ yes no
  - If air intake is blocked will unit lockout? _____ yes no
- B. Water Temperature
  - Is the thermostat adjusted to the lowest acceptable temperature? _____ yes no
  - Does the installation have a mixing valve? _____ yes no
  - If so, is it operational? _____ yes no
  - What is the outlet temperature of the mixing valve? _____ yes no

NOTE: To minimize the risk of scalding, the manufacturer recommends storing water at 120° F.

- Is a properly rated temperature and pressure relief valve installed? _____ yes no
- Is there a properly installed expansion tank? _____ yes no
- Should there be? _____ yes no
- C. Electrical
  - Is the 120 VAC electrical powers supply properly wired? (including polarity) _____ yes no
  - Are all the BTH control covers in place? _____ yes no
  - Is the 120 VAC electrical power supply properly fused? _____ yes no
- D. Flammables
  - Are flammable materials located in the area of the water heater? or air intake? _____ yes no
  - Are flammable vapors located in the area of the water heater? or air intake? _____ yes no
- E. Gas
  - If the gas supply is reduced or turned off will the unit turn off? _____ yes no
  - Comments: _____

[This service checklist may be photo copied to assist with BTH service calls.]

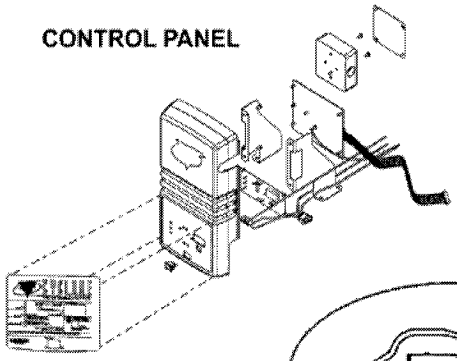
Downloaded from www.Manualslib.com manuals search engine

A.O.SMITH
WATER PRODUCTS COMPANY

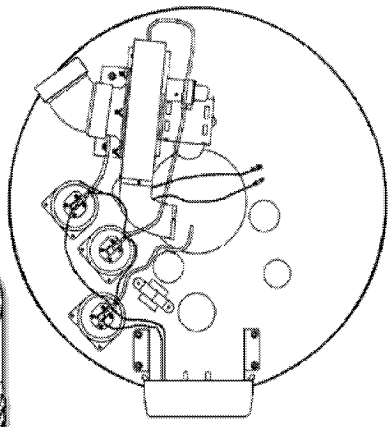
GAS

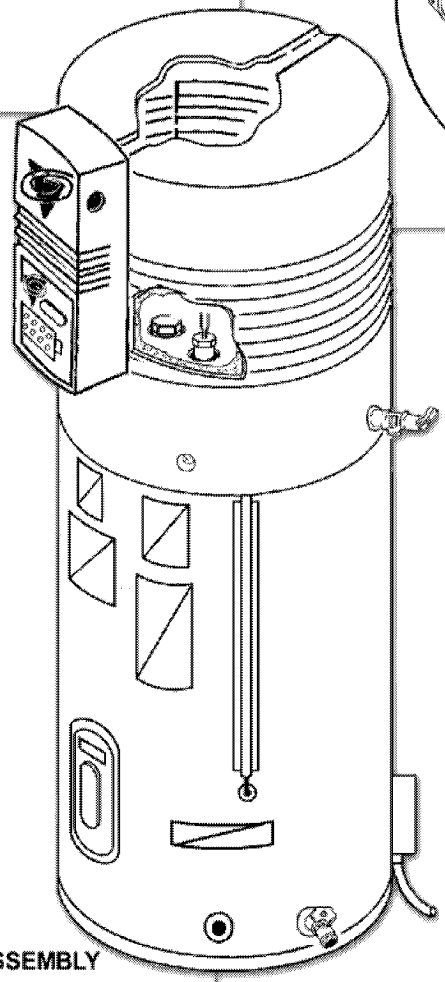
COMMERCIAL WATER HEATER PARTS LIST
MODEL BTH - 120, 150,199,250
SERIES 970 & 973

CONTROL PANEL

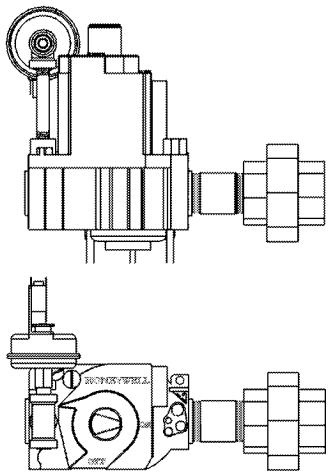


TOP COVER CONTROLS

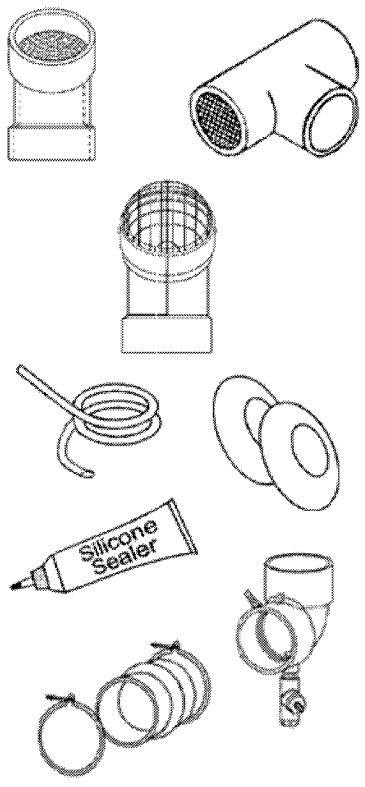




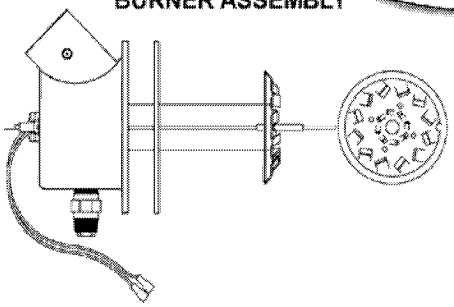
GAS VALVE



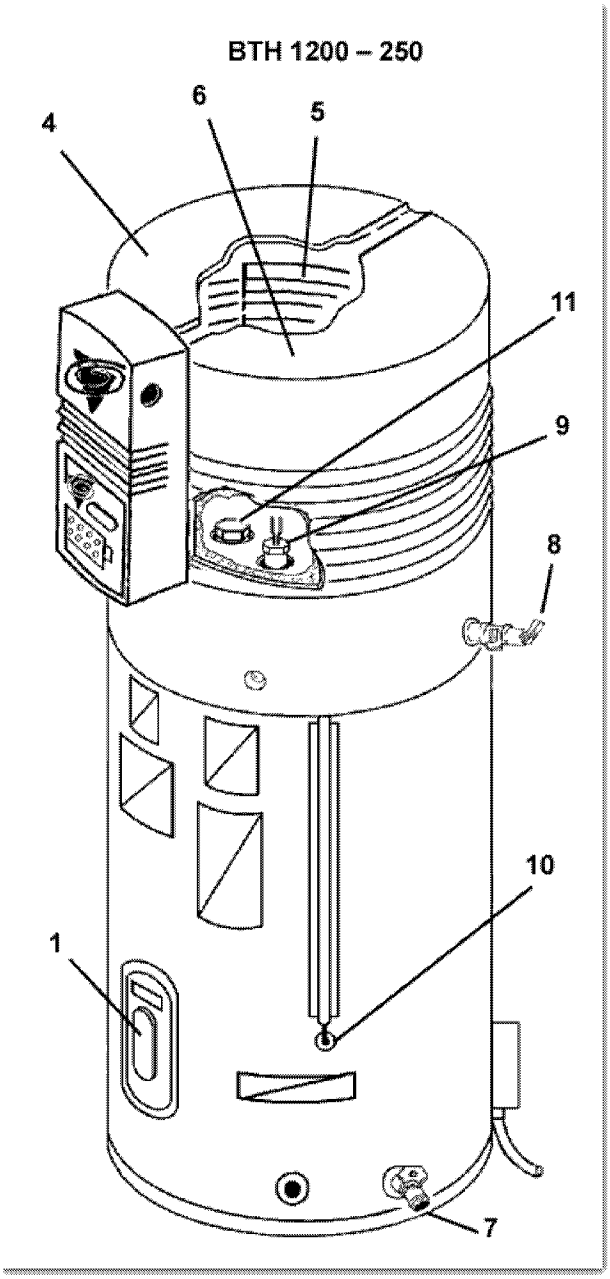
EXHAUST ELBOW & VENT KIT PARTS

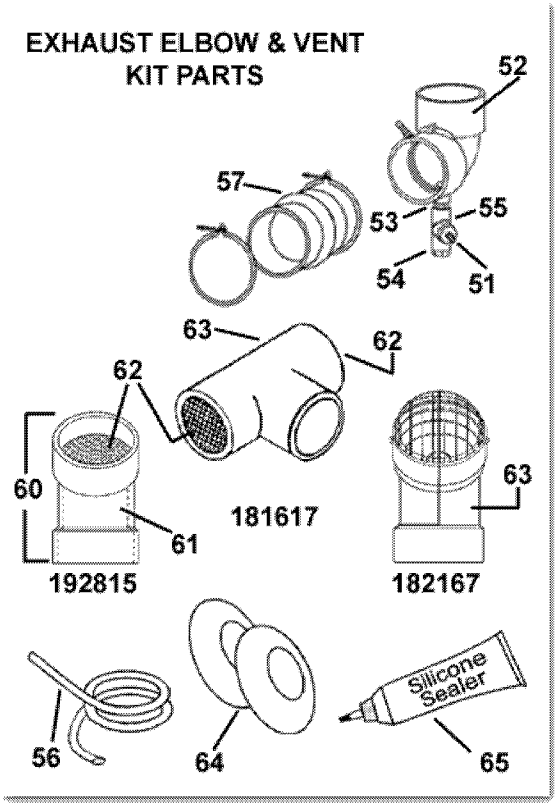


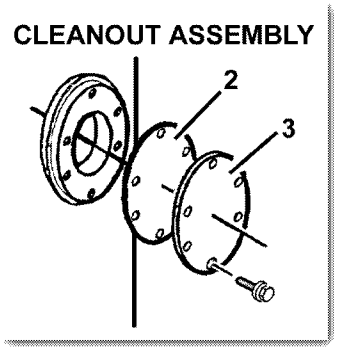
BURNER ASSEMBLY

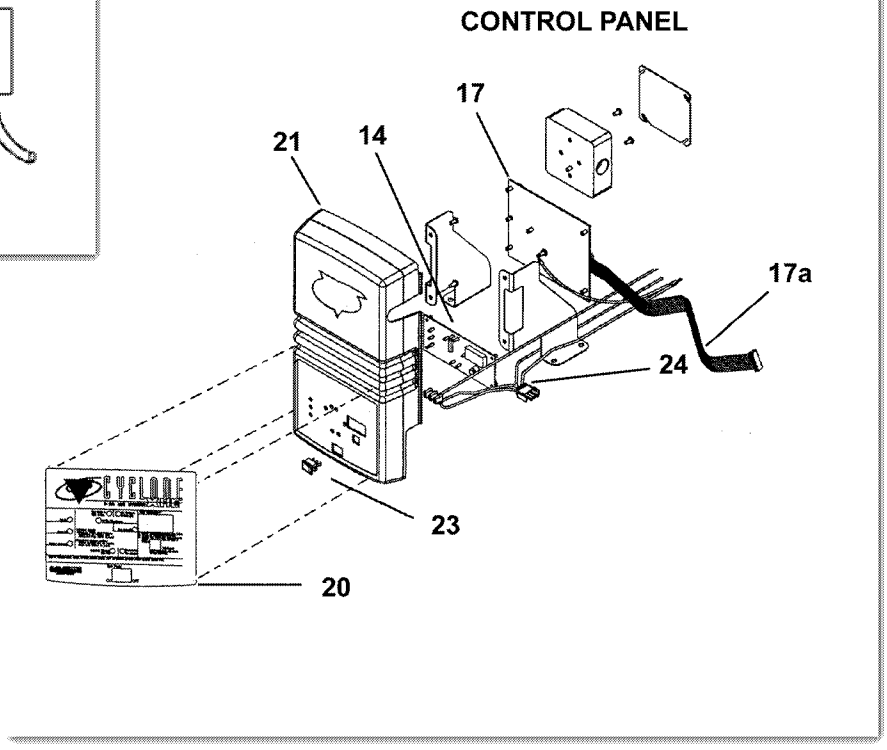


Downloaded from www.Manualslib.com manuals search engine



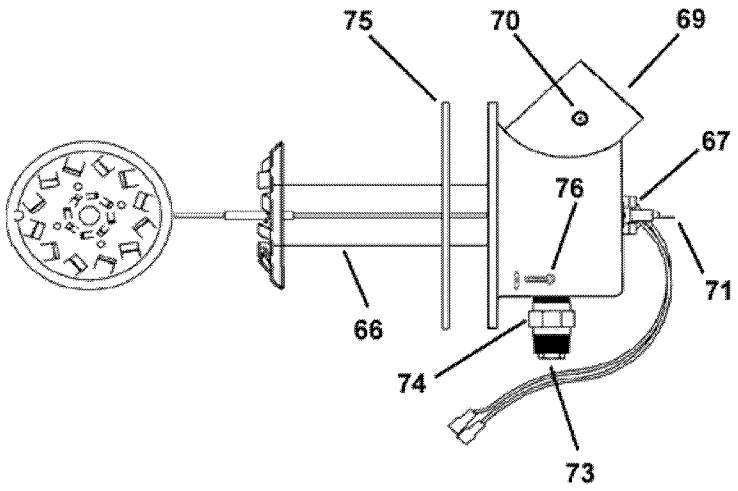




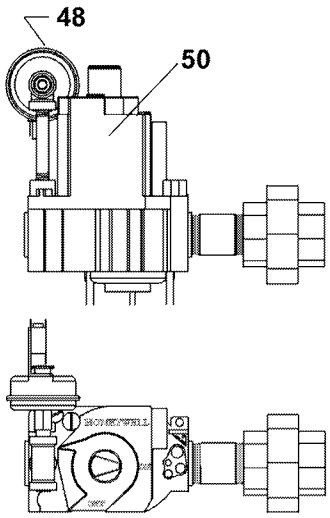


Downloaded from www.Manualslib.com manuals search engine

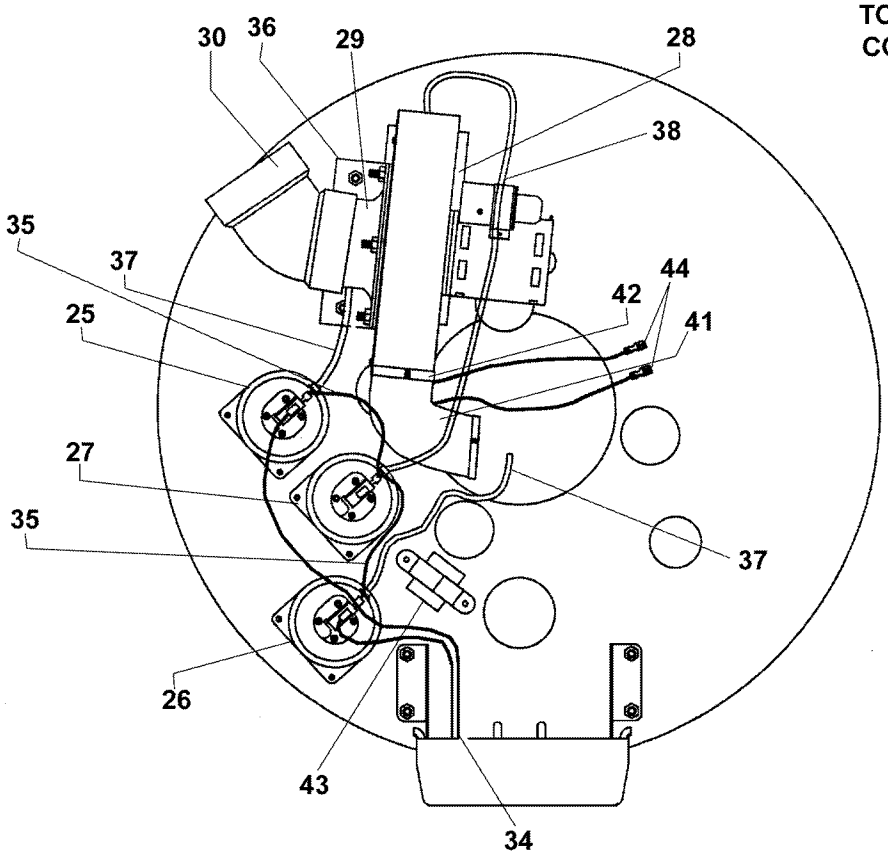
BURNER ASSEMBLY



GAS VALVE



TOP COVER CONTROLS



Downloaded from www.Manualslib.com manuals search engine

#	DESCRIPTION	BTH 120 970	BTH 120 973	BTH 150 970	BTH 150 973	BTH 199 970	BTH 199 973	BTH 250 970
1	Cleanout Cover	181260	181260	181260	181260	181260	181260	181260
2	Cleanout Gasket	99038	99038	99038	99038	99038	99038	99038
3	Cleanout Plate	99037	99037	99037	99037	99037	99037	99037
4	Top Cover, Left	193885	193885	193885	193885	193885	193885	193885
5	Top Cover, Right	193886	193886	193886	193886	193886	193886	193886
6	Top Cover, Back, Nat.	193887	193887	193887	193887	193887	193887	193887
6	Top Cover, Back, Prop.	193887	193887	193887	193887	193887	193887	- - - - -
7	Drain Valve	26273-6	26273-6	26273-6	26273-6	26273-6	26273-6	26273-6
8	T & P Relief Valve	99465-7	99465-7	99465-7	99465-7	99465-7	99465-7	192467
9	Upper Temp. Probe w/ECO	192606	192606	192606	192606	192606	192606	192606
10	Lower Temp. Probe	192609	192609	192609	192609	192609	192609	192609
11	Anode, Alum. Alloy (4)	183523-33	183523-52	183523-52	183523-52	183523-52	183523-52	183523-52
13	Manual*	196145	196145	196145	196145	196145	196145	196145
CYCLONE XHE BTH — CONTROL PANEL								
14	Board, Display Panel	192622-1	192622-1	192622-1	192622-1	192622-1	192622-1	192622-1
17	Control Board & Cable Assem. (includes 17a)	193822	193822	193822	193822	193822	193822	193822
17a	Cable Assem., Control Board to Display Board	192623	192623	192623	192623	192623	192623	192623
20	Display Panel Label	194203	194203	194203	194203	194203	194203	194203
21	Panel, Front	193884	193884	193884	193884	193884	193884	193884
23	On/Off Switch	193243	193243	193243	193243	193243	193243	193243
24	Cable Assembly, Line Power	194261	194261	194261	194261	194261	194261	194261
BTH 120 - 250 TOP COVER CONTROLS								
25	Blocked Inlet Switch, Natural Gas	193293	- - - - -	193363	- - - - -	193363	- - - - -	193361
25	Blocked Inlet Switch, Propane Gas	- - - - -	193356	- - - - -	193355	- - - - -	195012	- - - - -
26	Blocked Outlet Switch, Natural Gas	193294	- - - - -	193362	- - - - -	193364	- - - - -	193357
26	Blocked Outlet Switch, Propane Gas	- - - - -	193357	- - - - -	193357	- - - - -	193357	- - - - -
27	Blower Prover Switch	194706	194706	194706	194706	194706	194706	194706
28	Blower/Motor Assembly	194675	194675	194673	194675	194673	194675	194674
29	Inlet Flange Assembly w/ Hose Barb	192886-1	192886-1	192886-1	192886-1	192886-1	192886-1	192886-1
30	Intake Assembly	192815	192815	192815	192815	192815	192815	194116
34	Cable Assembly, Low Voltage	193246	193246	193246	193246	193246	193246	193246
35	Wire Assembly, Air Flow	192802	192802	192802	192802	192802	192802	192802
36	Bracket, Blower Mounting	192482	192482	192482	192482	192482	192482	192482
37	Tube, Pressure	193738-8	193738-8	193738-8	193738-8	193738-8	193738-8	193738-8
38	Tube, Pressure	193738-22	193738-22	193738-22	193738-22	193738-22	193738-22	193738-22
41	Tube, Air	192469-10	192469-10	192469-10	192469-10	192469-10	192469-10	192469-10
43	Transformer, 120V-24V,60 Hz,20 VA	192608	192608	192608	192608	192608	192608	192608

Downloaded from www.Manualslib.com manuals search engine

#	DESCRIPTION	BTH 120 970	BTH 120 973	BTH 150 970	BTH 150 973	BTH 199 970	BTH 199 973	BTH 250 970
44	Wire Assembly, Air Flow Switch	192802-1	192802-1	- - - - -	- - - - -	- - - - -	- - - - -	192802-1
GAS VALVE								
48	Switch, Low Gas Pressure, Natural	191149-5	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	191149-5
48	Switch, Low Gas Pressure, Propane	- - - - -	191149-4	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -
50	Gas Valve, Natural Gas	192966	- - - - -	192797	- - - - -	192797	- - - - -	192454
50	Gas Valve, Propane Gas	- - - - -	192967	- - - - -	192454-1	- - - - -	192454-1	- - - - -
EXHAUST ELBOW, VENT KIT PARTS								
51	Adapter, Hose Fitting	192472	192472	192472	192472	192472	192472	192472
52	Elbow 90°	192473	192473	192473	192473	192473	192473	192473
53	Nipple, Close	194558	194558	194558	194558	194558	194558	194558
54	Plug, Hex	194560	194560	194560	194560	194560	194560	194560
55	Tee	194559	194559	194559	194559	194559	194559	194559
56	Tubing	191746-72	191746-72	191746-72	191746-72	191746-72	191746-72	191746-72
57	Connector, Exhaust	192636	192636	192636	192636	192636	192636	192636
VENT KIT PARTS								
60	Elbow w/Screen	192815	192815	192815	192815	192815	192815	192815
61	Elbow, 45° x 3.5"	181901	181901	181901	181901	181901	181901	181901
62	Screen	181662	181662	181662	181662	181662	181662	181662
63	Intake Vent Terminal Assy.	- - - - -	- - - - -	182167	182167	181617	181617	181617
64	Wall Plates (2 Req'd.)	181557	181557	181557	181557	181557	181557	181557
65	Silicone Sealer, 2 oz. Tube	181564	181564	181564	181564	181564	181564	181564
BURNER — ASSEMBLY								
66	Burner	196162	- - - - -	196162	- - - - -	196162	- - - - -	196162
66	Burner for (BTH - 120, 150, 199) 973	- - - - -	196162-1	- - - - -	196162-1	- - - - -	196162-1	- - - - -
67	Ignitor Assembly	192638	192638	192638	192638	192638	192638	192638
69	Air Restrictor — Natural Gas	192450-3	- - - - -	192450-1	- - - - -	192450	- - - - -	192450-2
69	Air Restrictor — Propane Gas	- - - - -	192450-5	- - - - -	192450-5	- - - - -	192450	- - - - -
70	Hose Barb	192800-1	192800-1	192800-1	192800-1	192800-1	192800-1	192800-1
71	Flame Rod Assembly	192478	192478	192478	192478	192478	192478	192478
73	Orifice — Natural Gas	192477-3	- - - - -	192477-1	- - - - -	192477	- - - - -	192477-2
73	Orifice — Propane Gas	- - - - -	192477-6	- - - - -	192477-5	- - - - -	192477-10	- - - - -
74	Orifice Holder	192447	192447	192447	192447	192447	192447	192447
75	Gasket	192331	192331	192331	192331	192331	192331	192331
76	5/16" X 7/8" Socket Head Cap Screw (4 Req'd.)	192515-2	192515-2	192515-2	192515-2	192515-2	192515-2	192515-2

*Not illustrated.

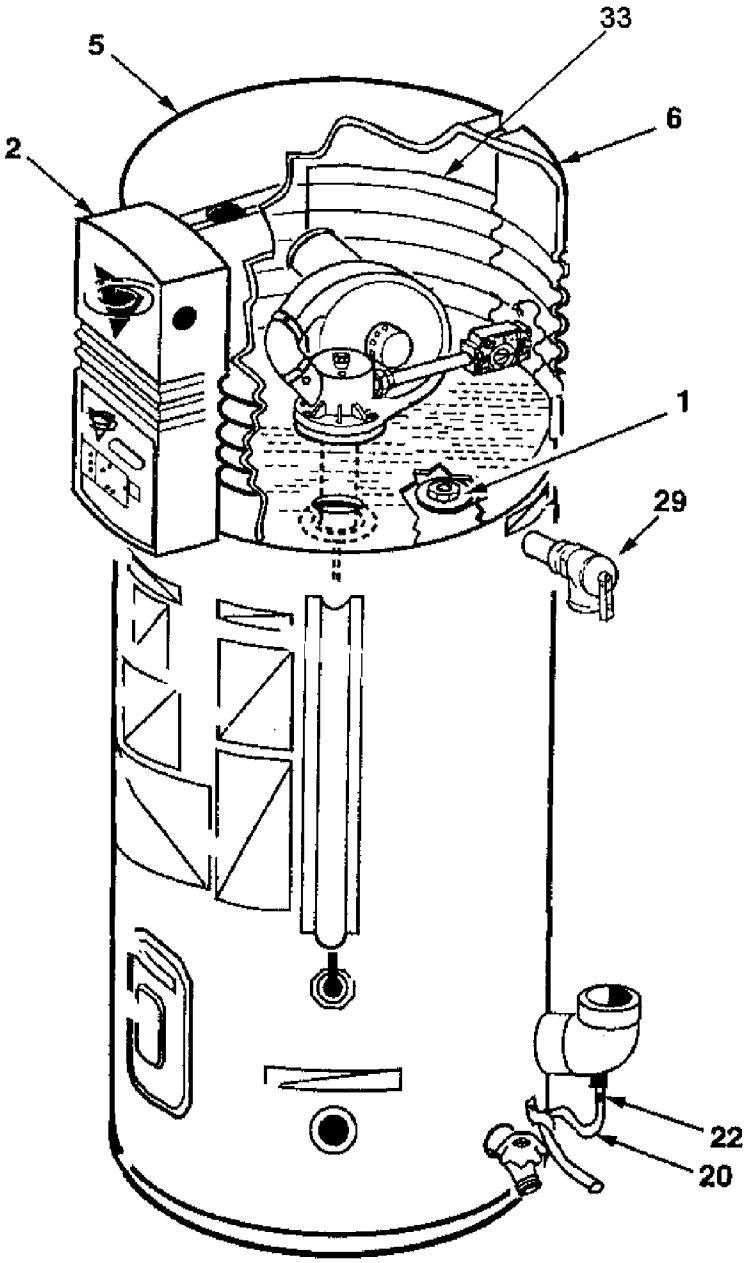
NOTE: Shaded parts are recommended stock items for emergency replacement. Consider gas used in your area only. Standard hardware items may be purchased locally.

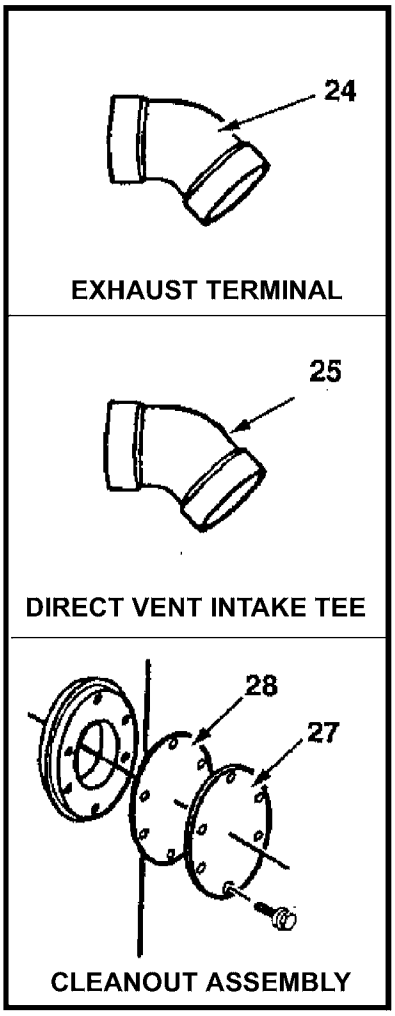
Downloaded from www.Manualslib.com manuals search engine

A.O.SMITH
WATER PRODUCTS
COMPANY

GAS

COMMERCIAL WATER HEATER PARTS LIST
CYCLONE XHE® MODEL BTH - 120
SERIES 966/967
(PARTIAL PARTS LISTING)





A. O. SMITH WATER PRODUCTS CO.,INC.
PARTS INFORMATION
PHONE: 1-800-433-2545
FAX: 1-800-433-2515 • WWW.AOSMITHWATERHEATERS.COM

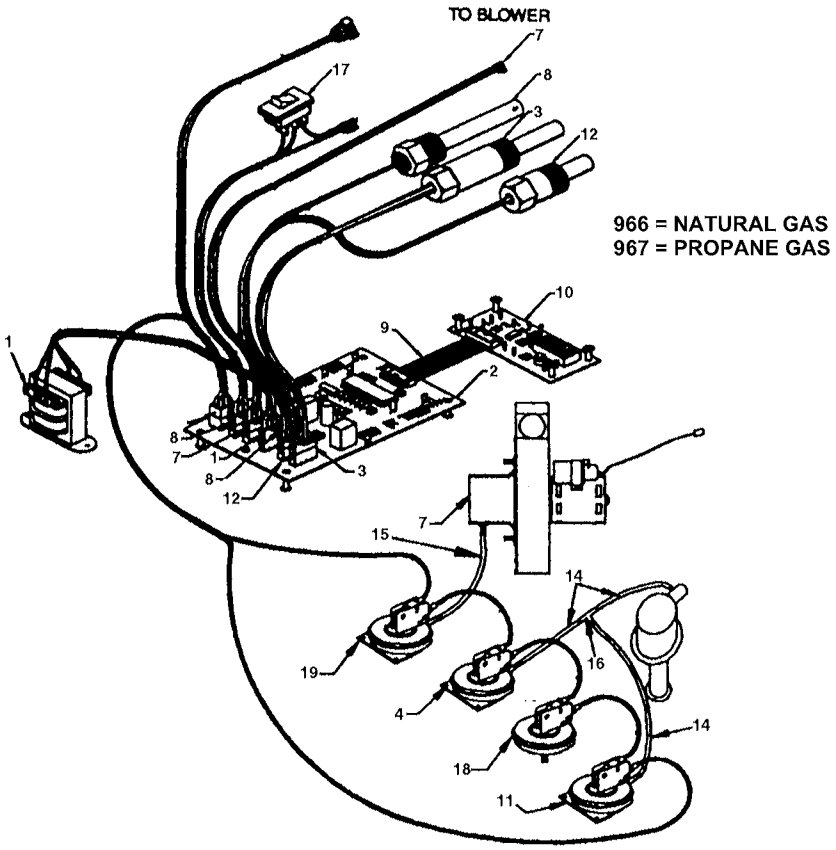
Downloaded from www.Manualslib.com manuals search engine

CYCLONE XHE® MODEL
BTH - 120 WATER HEATER PARTS LIST (PARTIAL)
SERIES 966/967

ITEM	DESCRIPTION	BTH – 120
1	Anode	043817-029
2	Panel, Front	193884-000
5	Panel, Left Side	193885-000
6	Panel, Right Side	193886-000
20	Condensate Hose	181864-072
22	Barb, Hose	181863-000
24	Exhaust Terminal	192815-000
25	Intake Terminal	192815-000
27	Plate, Pressure	099037-000
28	Gasket	099038-000
29	Valve, Relief	192467-000
30	Clamp, Hose, Nylon Snap	191794-001
33	Panel, Back	193887-000
36	Instruction Manual	194119-000

Downloaded from www.Manualslib.com manuals search engine

CYCLONE XHE® MODEL
BTH - 120 CONTROLS PART LIST — SERIES 966/967

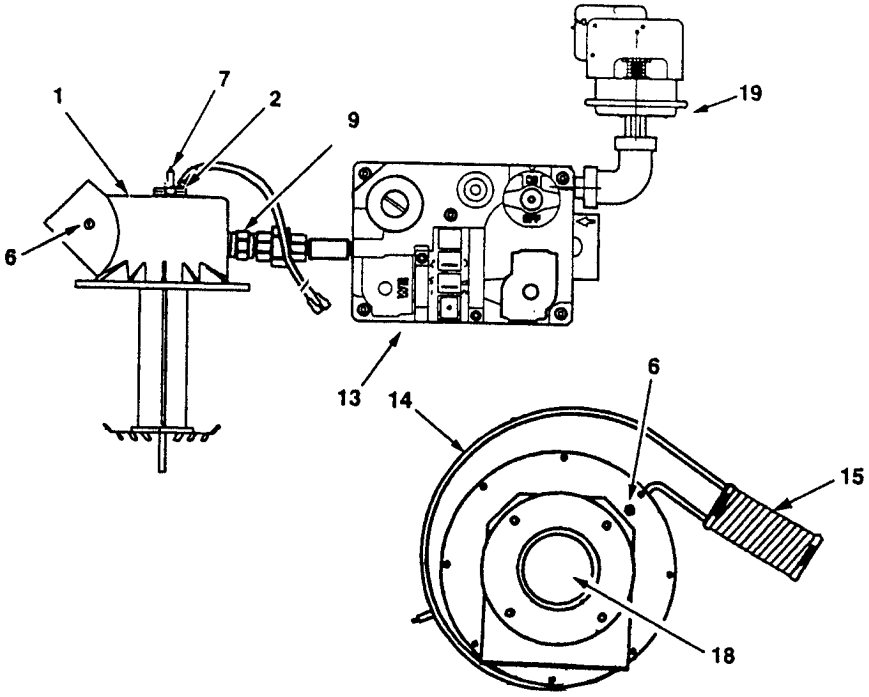


ITEM	DESCRIPTION	BTH-120
1	Transformer	192608-001
2	Control Board	193822-000
3	E.C.O./Temperature Probe	192606-000
4	Blower Proving Air Switch	193295-000
7	Blower Assembly	193341-000
8	Igniter Assembly	192638-000
9	Cable to Control Display Board	192623-000
10	Board, Display Panel	192622-001
11	Blocked Outlet Proving Switch	193294-000
12	Temperature Probe, Lower	192609-000
14	Tubing, Pressure	192024-002
15	Tubing, Pressure	192024-006
16	Tubing, Connector	192152-000
17	Switch-On/Off	193243-000
18	Low Nat. Gas Pressure Switch	191149-001
19	Low Prop. Gas Pressure Switch	191149-004
20	Blocked Inlet Switch	193293-000

Part numbers in shaded cells are recommend stock items for emergency replacement.

Downloaded from www.Manualslib.com manuals search engine

CYCLONE XHE® MODEL
BTH - 120 BURNER & BLOWER PARTS LIST — SERIES 966/967



ITEM	DESCRIPTION	BTH-120
1	Nat Burner	194114-003
1	Prop Burner	194114-006
2	Igniter Assembly	192638-000
6	Barb, Hose, 3/16”	181863-000
7	Flame Rod Assembly	192478-000
9	Nat Orifice	192477-003
9	Prop Orifice	192477-006
13	Valve, Nat Gas	192966-000
13	Valve, Prop Gas	192967-000
14	Blower	193341-000
15	Tube, Air	192469-010
18	Flange Assembly, Inlet	192886-001
19	Low Nat. Gas Pressure Switch	191149-001
19	Low Prop. Gas Pressure Switch	191149-004

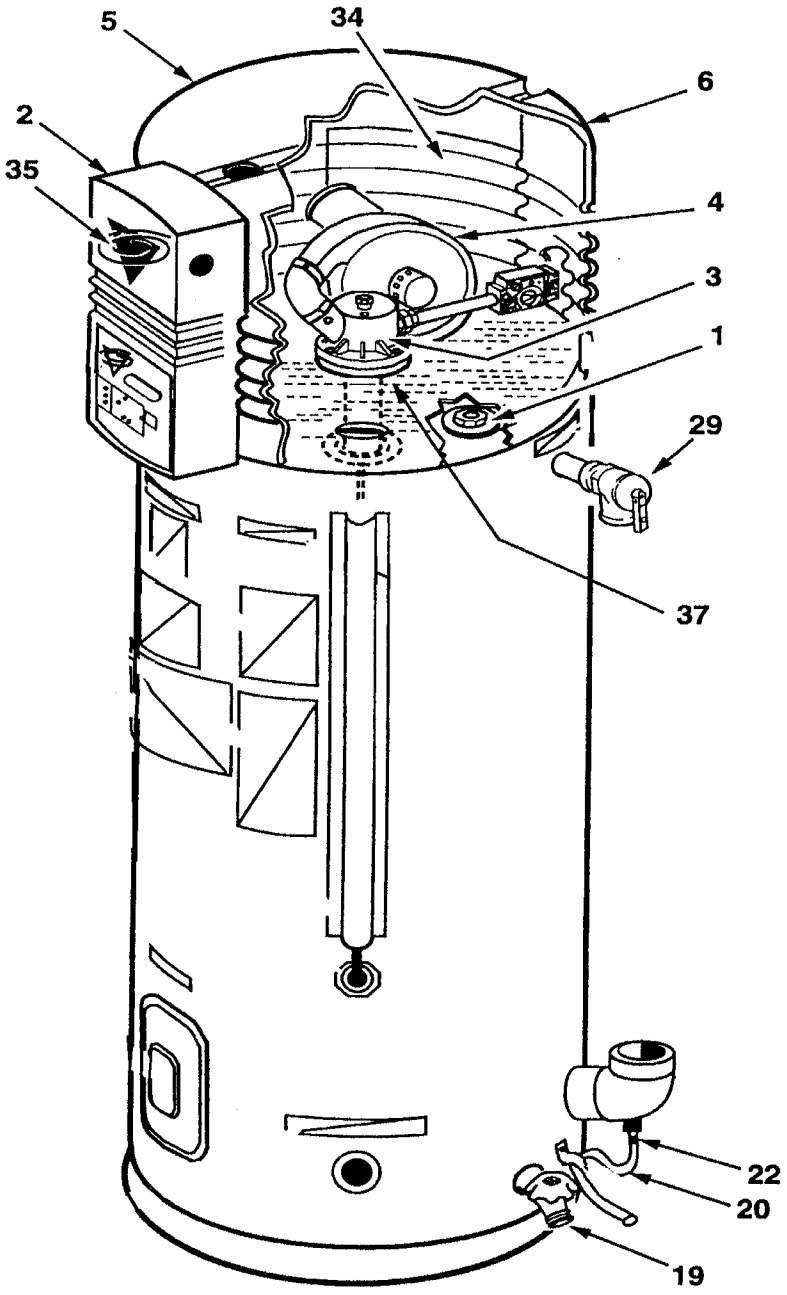
Part numbers in shaded cells are recommended stock items for emergency replacement.

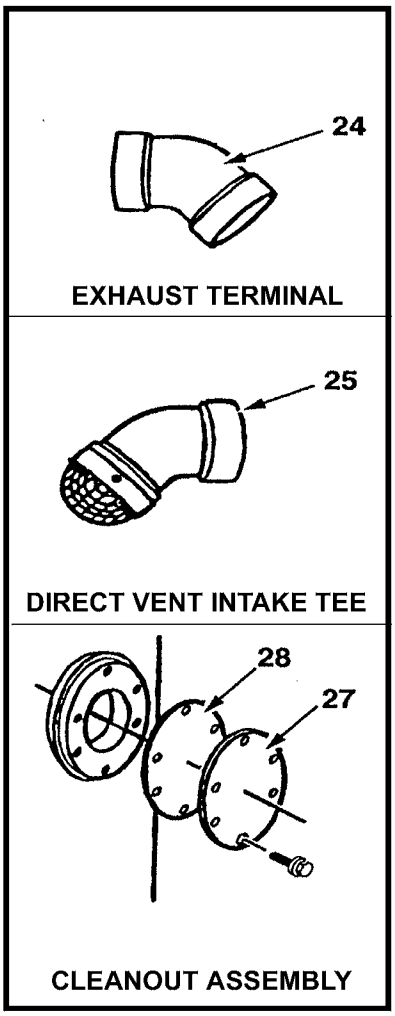
Downloaded from www.Manualslib.com manuals search engine

A.O.SMITH
WATER PRODUCTS COMPANY

GAS

COMMERCIAL WATER HEATER PARTS LIST
CYCLONE XHE® MODEL BTH - 150, BTH - 199
SERIES 966 & 967
(PARTIAL PARTS LISTING)





A. O. SMITH WATER PRODUCTS CO.,INC.
PARTS INFORMATION
PHONE: 1-800-433-2545
FAX: 1-800-433-2515 • WWW.AOSMITHWATERHEATERS.COM

Downloaded from www.Manualslib.com manuals search engine

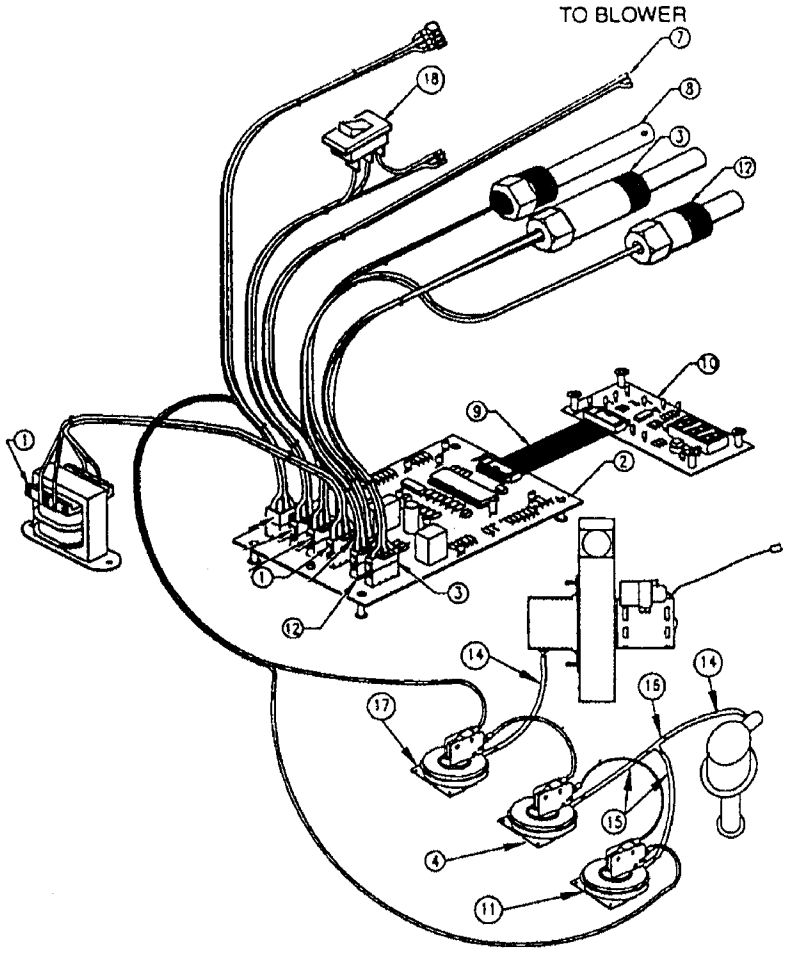
CYCLONE XHE® MODELS
BTH - 150 & BTH - 199 SERIES 966 & 967
CONTROLS PARTS LIST (PARTIAL)

ITEM	DESCRIPTION	BTH - 150		BTH - 199	
		NATURAL (966)	PROPANE (967)	NATURAL (966)	PROPANE (967)
1	Anode	043817-053	043817-053	043817-053	043817-053
2	Panel, Front	194884-000	194884-000	194884-000	194884-000
3	Burner Assembly	194114-001	194114-005	194114-000	194114-004
4	Blower	193354-000	193354-000	193354-000	193354-000
5	Panel, Left Side	193885-000	193885-000	193885-000	193885-000
6	Panel, Right Side	193886-000	193886-000	193886-000	193886-000
19	Valve, Drain	026273-004	026273-004	026273-004	026273-004
20	Condensate Hose	191746-072	181894-072	191746-072	181894-072
22	Barb, Hose	181863-000	181863-000	181863-000	181863-000
24	Exhaust Terminal	192815-000	192815-000	192815-000	192815-000
25	Direct Vent Kit	193202-000	193202-000	193202-000	193202-000
27	Plate, Pressure	099037-000	099037000	099037-000	099037-000
28	Gasket	099038-000	099038-000	099038-000	099038-000
29	Valve, Relief	192467-000	192467-000	192467-000	192467-000
33*	Screen, Exhaust	181662-000	181662-000	181662-000	181662-000
34	Panel, Back	193887-000	193887-000	193887-000	193887-000
37	Gasket	192331-000	192331-000	192331-000	192331-000

*Not Illustrated

Downloaded from www.Manualslib.com manuals search engine

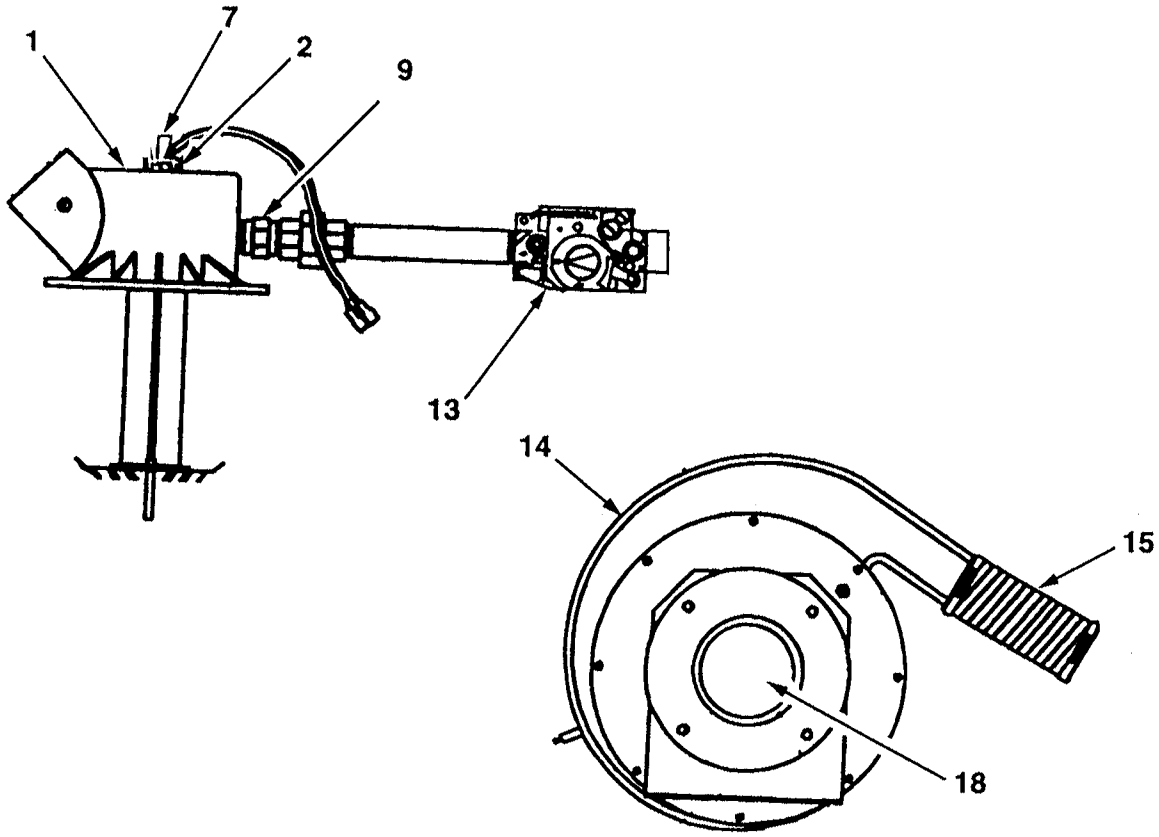
CYCLONE XHE® MODELS
BTH - 150 & BTH - 199 SERIES 966 & 967 CONTROLS PARTS LIST



ITEM	DESCRIPTION	BTH - 150		BTH - 199	
		NATURAL	PROPANE	NATURAL	PROPANE
		(966)	(967)	(966)	(967)
1	Transformer	192608-001	192608-001	192608-001	192608-001
2	Control Board	193822-000	193822-000	193822-000	193822-000
3	E.C.O./Upper Probe	192606-000	192606-000	192606-000	192606-000
4	Blower Proving Switch	193295-000	193295-000	193295-000	193295-000
7	Blower Assembly	192880-000	192880-000	192880-000	192880-000
8	Igniter Assembly	192638-000	192638-000	192638-000	192638-000
9	Cable to Control Display Board	192623-001	192623-000	192623-000	192623-000
10	Board, Display Panel	192622-001	192622-001	192622-001	192622-001
11	Blocked Outlet Switch	193362-000	193357-000	193364-000	193357-000
12	Temperature Probe, Lower	192609-000	192609-000	192609-000	192609-000
14	Tubing, Pressure	192024-006	192024-0006	192024-006	192024-006
15	Tubing, Pressure	192024-004	192024-004	192024-004	192024-004
16	Connector, Tube	192152-000	192152-000	192152-000	192152-000
17	Blocked Inlet Switch	193363-000	193355-000	193363-000	193356-000
18	ON/OFF Switch	193243-000	193234-000	193234-000	193234-000

Downloaded from www.Manualslib.com manuals search engine

CYCLONE XHE® MODELS
BTH - 150 & BTH - 199 SERIES 966 & 967 BURNER & BLOWER PARTS LIST



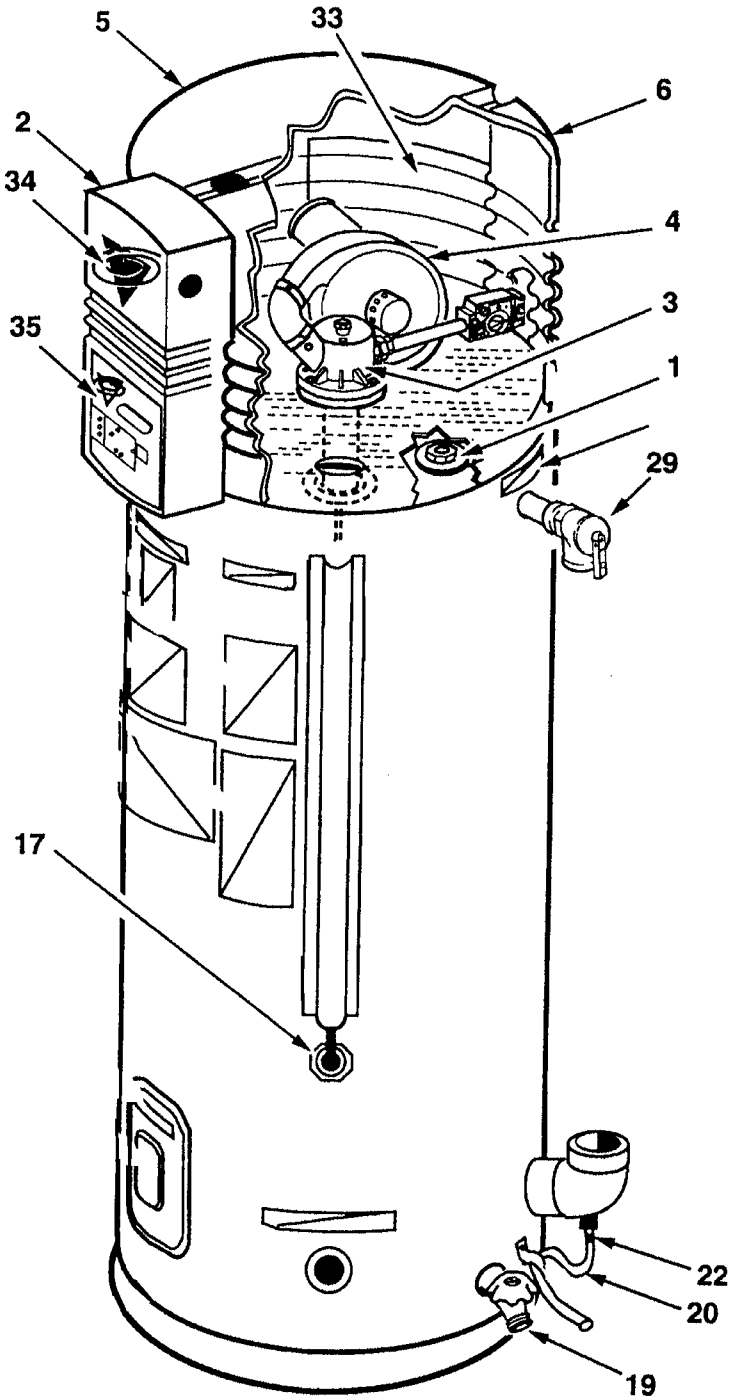
ITEM	DESCRIPTION	BTH - 150		BTH - 199	
		NATURAL	PROPANE	NATURAL	PROPANE
		(966)	(967)	(966)	(967)
1	Burner Assembly	194114-001	194114-005	194114-000	194114-004
2	Igniter Assembly	192638-000	192638-000	192638-000	192638-000
7	Flame Rod Assembly	192478-000	192478-000	192478-000	192478-000
9	Orifice	192477-001	192477-005	192477-000	192477-004
13	Valve, Gas	192797-000	192454-001	192797-000	192454-001
14	Blower	193354-000	193354-000	193354-000	193354-000
15	Tube, Air	192469-010	192469-010	192469-010	192469-010
18	Flange, Inlet	192641-001	192886-001	192641-001	192886-001

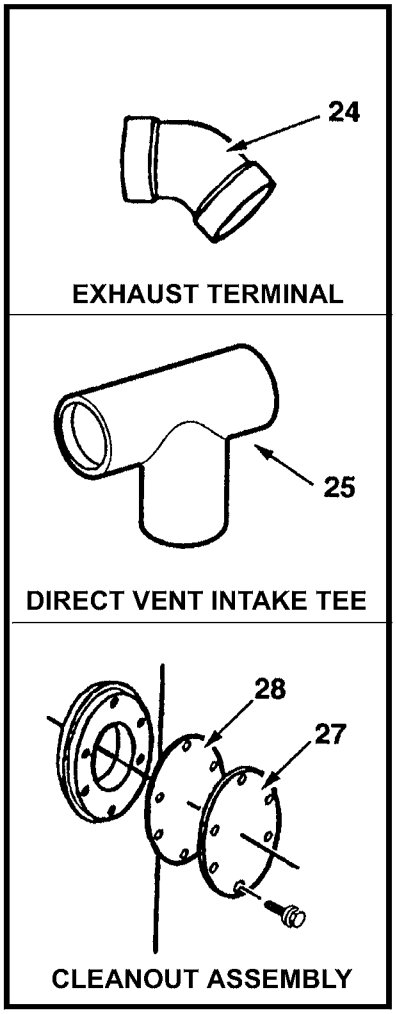
Downloaded from www.Manualslib.com manuals search engine

A.O.SMITH
WATER PRODUCTS COMPANY

GAS

COMMERCIAL WATER HEATER PARTS LIST
CYCLONE XHE® MODEL BTH - 250
SERIES 966
(PARTIAL PARTS LISTING)





A. O. SMITH WATER PRODUCTS CO.,INC.
PARTS INFORMATION
PHONE: 1-800-433-2545
FAX: 1-800-433-2515 • WWW.AOSMITHWATERHEATERS.COM

Downloaded from www.Manualslib.com manuals search engine

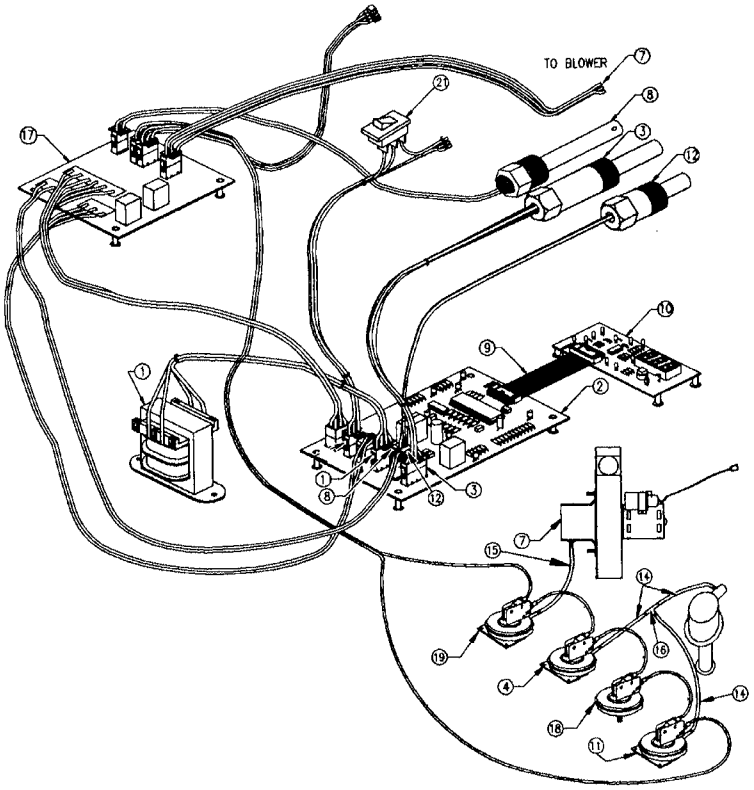
CYCLONE XHE® MODEL
BTH - 250 WATER HEATER PARTS LIST (PARTIAL)
SERIES 966

ITEM	DESCRIPTION	BTH - 250
1	Anode	043817-053
2	Panel, Front	194884-000
3	Burner Assembly	194114-002
4	Blower	193203-000
5	Panel, Left Side	193885-000
6	Panel, Right Side	193886-000
17	Temperature Probe, Lower	192609-000
19	Valve, Drain	026273-004
20	Condensate Hose	181894-072
22	Barb, Hose	181863-000
24	Exhaust Terminal	192815-000
25	Direct Vent Intake Terminal	181762-000
27	Plate, Pressure	099037-000
28	Gasket	099038-000
29	Valve, Relief	192467-000
33	Panel, Back	193887-000

Part numbers in shaded cells are recommended stock items for emergency replacement.

Downloaded from www.Manualslib.com manuals search engine

CYCLONE XHE® MODELS
BTH - 250 CONTROLS PARTS LIST — SERIES 966

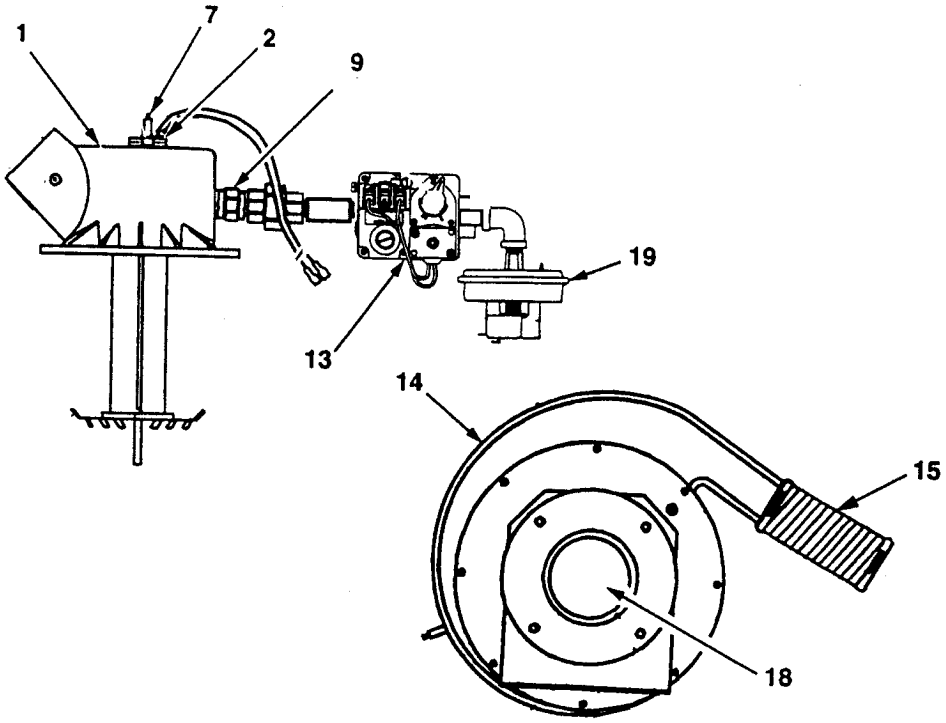


ITEM	DESCRIPTION	BTH - 250
1	Transformer	192608-001
2	Control Board	193822-000
3	E.C.O./Temperature Probe	192606-000
4	Blower Proving Air Switch	193295-000
7	Blower Assembly	193203-000
8	Igniter Assembly	192638-000
9	Cable to Control Display Board	192623-000
10	Board, Display Panel	192622-001
11	Blocked Outlet Proving Switch	193357-000
12	Temperature Probe, Lower	192609-000
14	Tubing, Pressure	192024-001
15	Tubing, Pressure	192024-006
16	Tubing, Connector	192152-000
17	Blower Speed Reducing Panel	192987-000
18	Low Gas Pressure Switch	191149-001
19	Blocked Inlet Switch	193361-000
21	Switch-On/Off	193243-000

Part numbers in shaded cells are recommended for stock items for emergency replacement.

Downloaded from www.Manualslib.com manuals search engine

CYCLONE XHE® MODELS
BTH - 250 BURNER & BLOWER PARTS LIST — SERIES 966



ITEM	DESCRIPTION	BTH - 250
1	Burner	194114-002
2	Igniter Assembly	192638-000
7	Flame Rod Assembly	192478-000
9	Orifice	192477-002
13	Valve, Gas	192454-000
14	Blower	193203-000
15	Tube, Air	192469-010
18	Flange Assembly, Inlet	192886-001
19	Low Gas Pressure Switch	191149-001

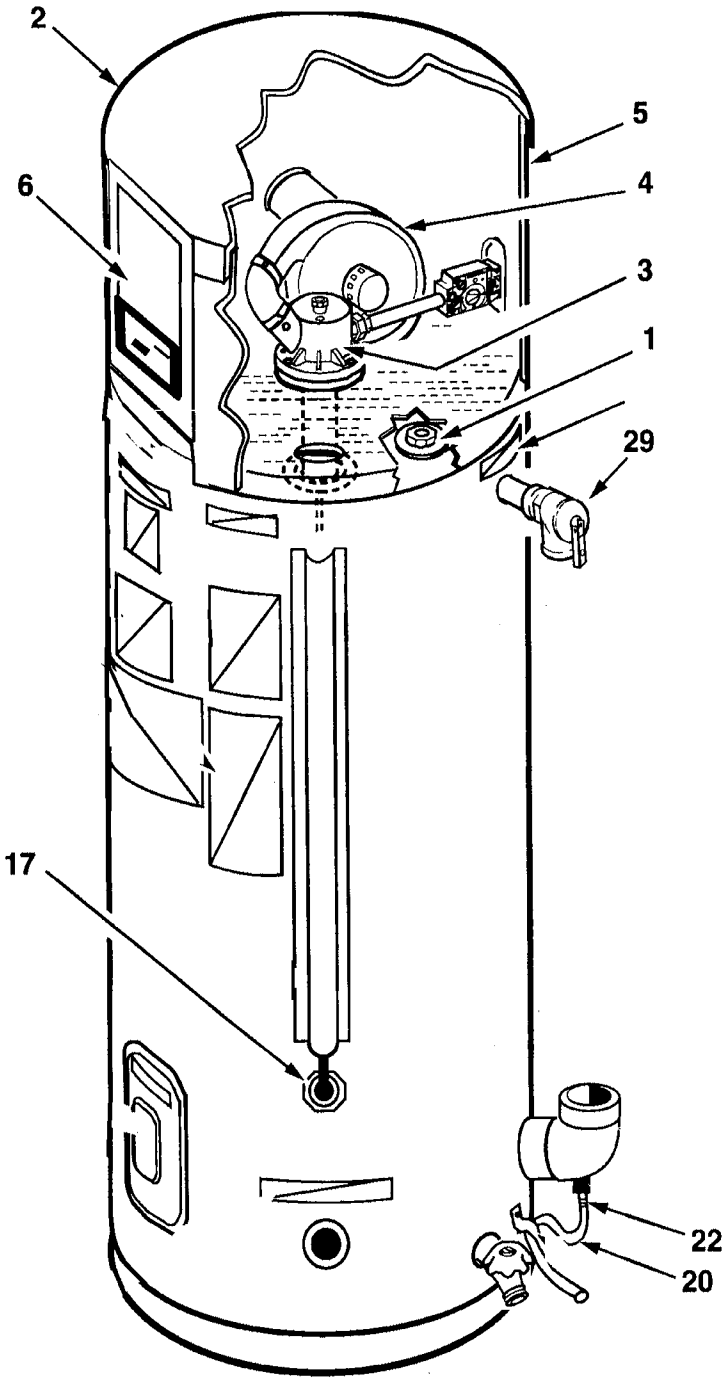
Part numbers in shaded cells are recommended for stock items for emergency replacement.

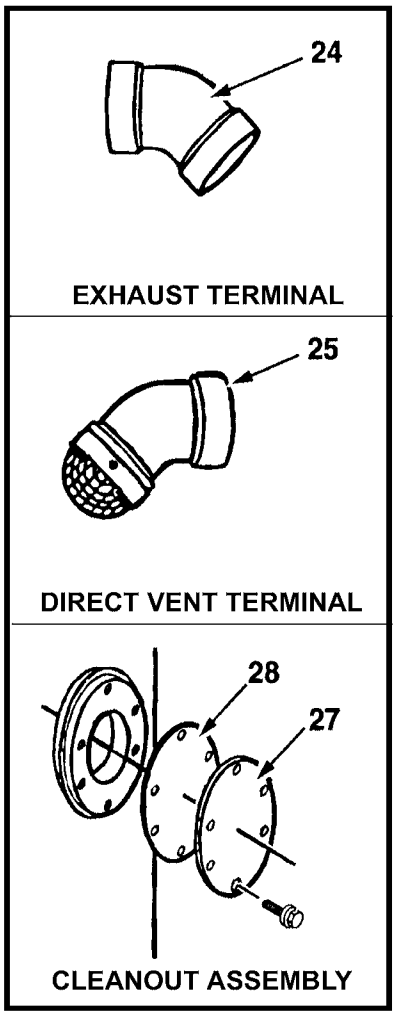
Downloaded from www.Manualslib.com manuals search engine

A.O.SMITH
WATER PRODUCTS COMPANY

GAS

COMMERCIAL WATER HEATER PARTS LIST
CYCLONE XHE® MODEL BTH - 150, BTH-199
SERIES 960
(PARTIAL PARTS LISTING)





A. O. SMITH WATER PRODUCTS CO.,INC.
PARTS INFORMATION
PHONE: 1-800-433-2545
FAX: 1-800-433-2515 • WWW.AOSMITHWATERHEATERS.COM

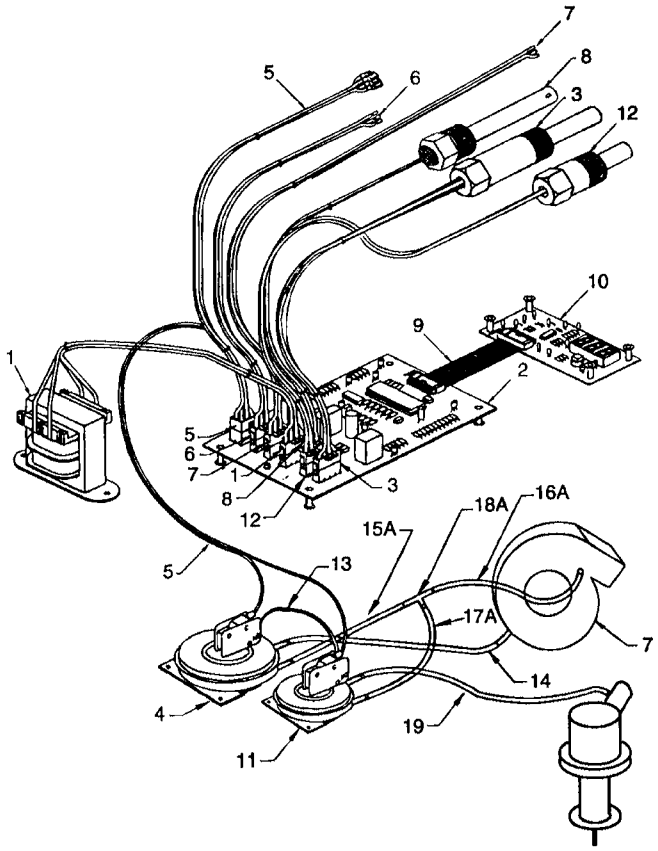
Downloaded from www.Manualslib.com manuals search engine

CYCLONE XHE® MODEL
BTH - 150 & BTH - 199 WATER HEATER PARTS LIST — SERIES 960

ITEM	DESCRIPTION	BTH - 150	BTH - 199
1	Anode	043817-053	043817-053
2	Cover, Jacket	192664-000	192664-000
3	Burner Assembly	192417-001	192417-001
4	Motor, Blower	192880-000	192880-000
5	Cage, Housing	192420-000	192420-000
6	Bracket, Control Panel	192716-000	192716-000
17	Temperature Probe, Lower	192609-000	192609-000
20	Condensate Hose	191746-072	191746-072
22	Barb, Hose	181863-000	181863-000
24	Exhaust Terminal	181901-000	181901-000
25	Direct Vent Kit	182167-000	182167-000
27	Plate, Pressure	099037-000	099037-000
28	Gasket	099038-000	099038-000
29	Valve, Relief	191617-000	191617-000

Downloaded from www.Manualslib.com manuals search engine

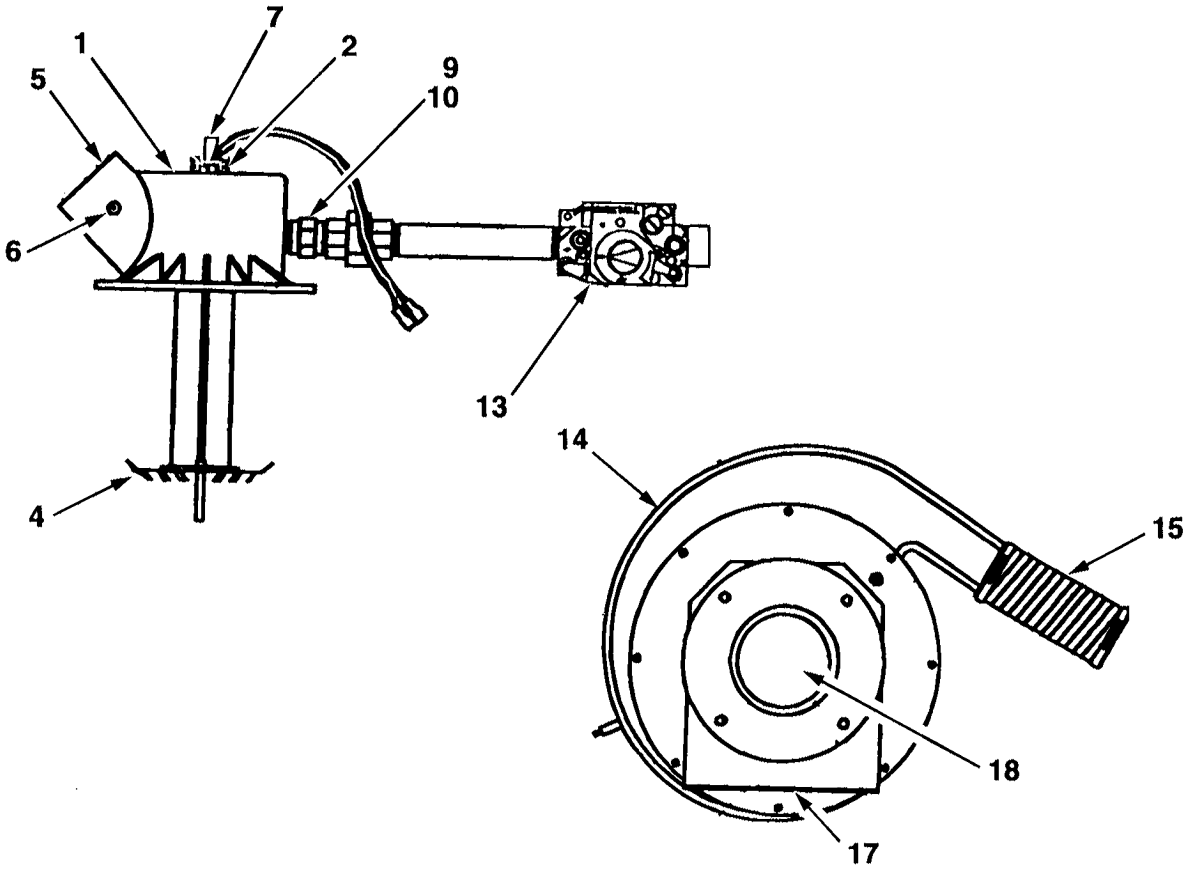
CYCLONE XHE® MODEL
BTH - 150 & BTH - 199 WATER HEATER PARTS LIST — SERIES 960



ITEM	DESCRIPTION	BTH - 150	BTH - 199
1	Transformer	192608-000	192608-000
2	Control Board	192624-000	192624-000
3	E.C.O./Temperature Probe	192606-000	192606-000
4	Blower Proving Air Switch	192811-000	192811-000
5	Low Voltage Cable Assembly	192605-000	192605-000
6	Line Voltage Cable Assembly	192607-000	192607-000
7	Blower Assembly	192468-000	192468-000
8	Igniter Assembly	192638-000	192638-000
9	Cable to Control Display Board	192623-000	192623-000
10	Board, Display Panel	192622-001	192622-001
11	Blocked Flue Proving Switch	192810-000	192810-000
12	Temperature Probe, Lower	192609-000	192609-000
13	Wire Assembly, Air Flow Switch	192802-000	192802-000
14	Tubing, Pressure	192024-014	192024-014
15A	Tubing, Pressure	192024-004	192024-004
16A	Tubing, Pressure	192024-004	192024-004
17A	Tubing, Pressure	192024-008	192024-008
18A	Connector, Tube	192152-000	192152-000
19	Tubing, Pressure	192024-008	192024-008

Downloaded from www.Manualslib.com manuals search engine

CYCLONE XHE® MODEL
BTH - 150 & BTH - 199 BURNER & BLOWER PARTS LIST — SERIES 960



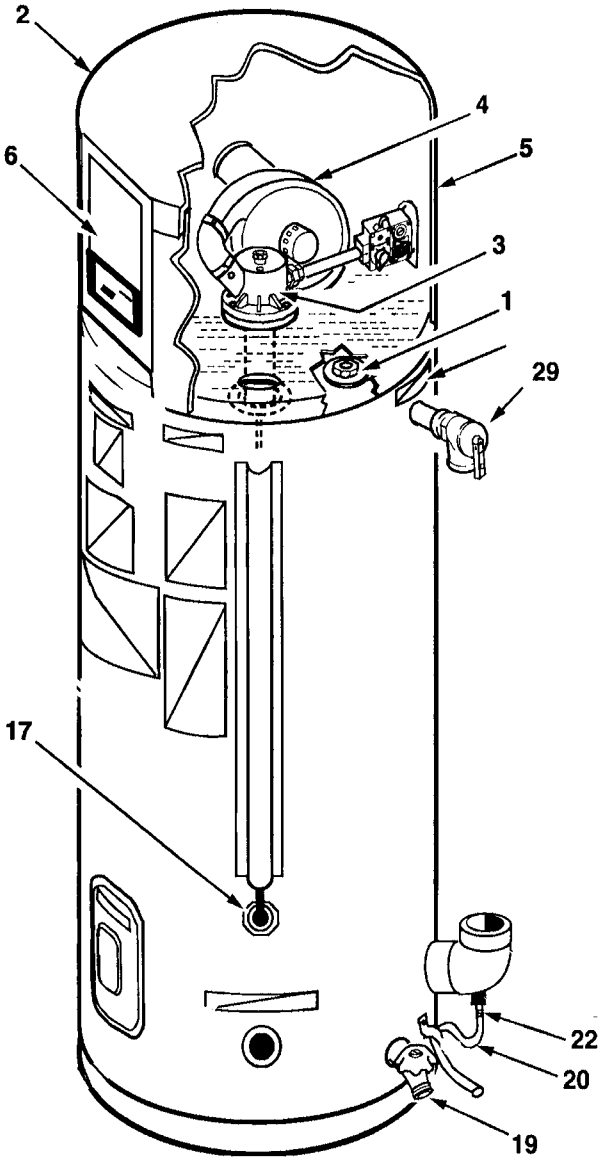
ITEM	DESCRIPTION	BTH - 150	BTH - 199
1	Burner	192416-000	192416-000
2	Igniter Assembly	192638-000	192638-000
4	Air Deflector	192414-000	192414-000
5	Air Restrictor	192450-001	192450-001
6	Barb, Hose, 3/16”	192800-000	192800-000
7	Flame Rode Assembly	192478-000	192478-000
9	Orifice	192477-001	192477-000
10	Orifice Holder	192447-000	192447-000
13	Valve, Gas	192797-000	192797-000
14	Blower	192468-000	192468-000
15	Tube, Air	192469-000	192469-000
17	Bracket, Blower Mounting	192482-000	192482-000
18	Flange Inlet	192641-000	192641-000

Downloaded from www.Manualslib.com manuals search engine

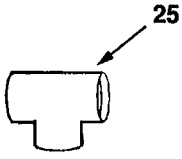
A.O.SMITH
WATER PRODUCTS
COMPANY

GAS

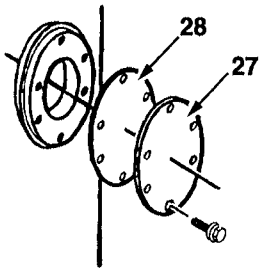
COMMERCIAL WATER HEATER PARTS LIST
CYCLONE XHE® MODEL BTH - 250
SERIES 962
(PARTIAL PARTS LISTING)



EXHAUST TERMINAL



DIRECT VENT INTAKE TEE



CLEANOUT ASSEMBLY

A. O. SMITH WATER PRODUCTS CO.,INC.
PARTS INFORMATION
PHONE: 1-800-433-2545
FAX: 1-800-433-2515 • WWW.AOSMITHWATERHEATERS.COM

Downloaded from www.Manualslib.com manuals search engine

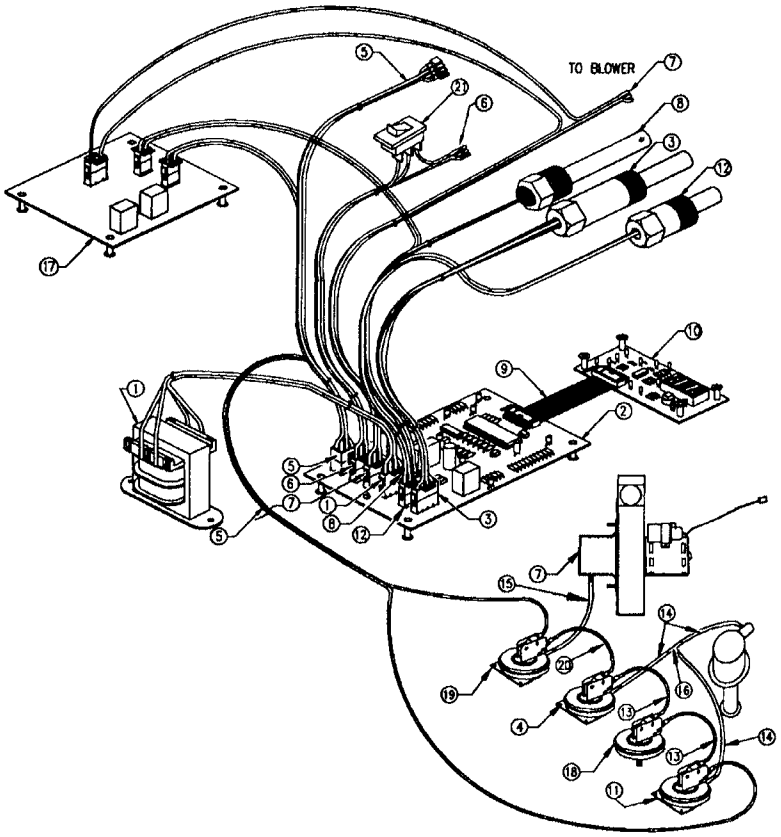
CYCLONE XHE® MODEL
BTH - 250 WATER HEATER PARTS LIST (PARTIAL)
SERIES 962

ITEM	DESCRIPTION	BTH - 250
1	Anode	043817-004
2	Cover, Jacket	192664-000
3	Burner Assembly	192417-003
4	Motor, Blower	193203-000
5	Cage, Housing	192420-000
6	Bracket, Control Panel	192716-000
17	Temperature Probe, Lower	192609-000
20	Condensate Hose	181864-000
22	Barb, Hose	181863-000
24	Exhaust Vent Terminal	192815-000
25	Direct Vent Intake Tee	181762-000
27	Plate, Pressure	099037-000
28	Gasket	099038-000
29	Valve, Relief	192467-000

Part numbers in shaded cells are recommended stock items for emergency replacement.

Downloaded from www.Manualslib.com manuals search engine

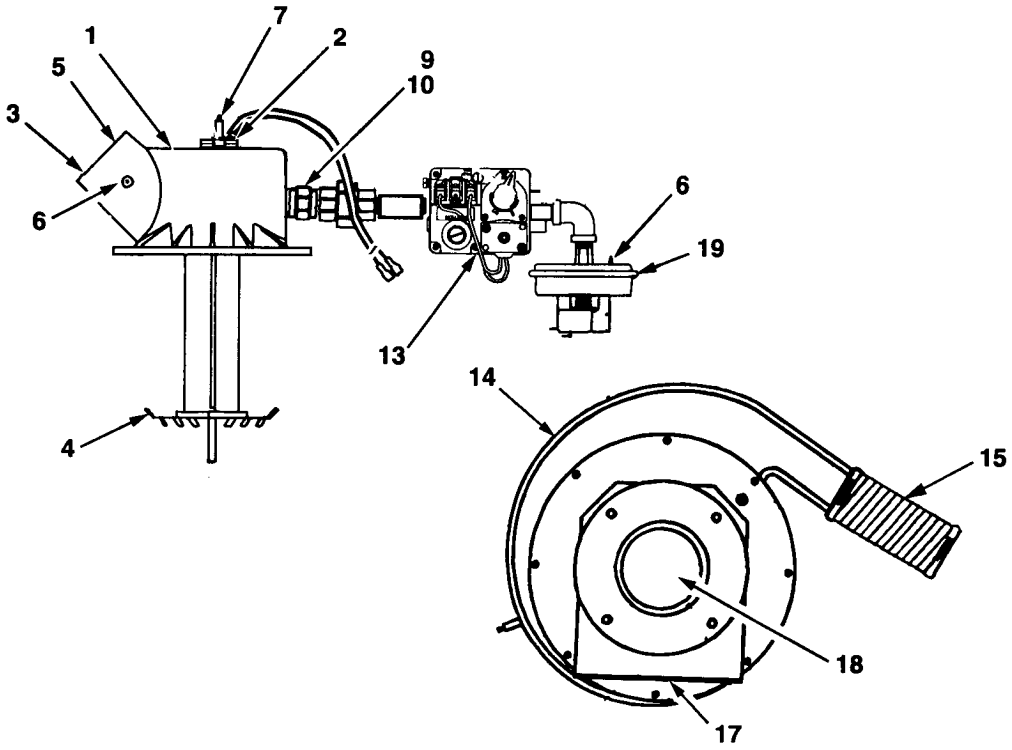
CYCLONE XHE® MODELS
BTH - 250 CONTROLS PARTS LIST — SERIES 962



ITEM	DESCRIPTION	BTH - 250
1	Transformer	192608-001
2	Control Board	192624-000
3	E.C.O./Temperature Probe	192606-000
4	Blower Proving Air Switch	193221-000
5	Low Voltage Cable Assembly	192605-000
6	Line Voltage Cable Assembly	192607-000
7	Blower Assembly	193203-000
8	Igniter Assembly	192638-001
9	Cable to Control Display Board	192623-000
10	Board, Display Panel	192622-000
11	Blocked Outlet Proving Switch	192946-000
12	Temperature Probe, Lower	192609-000
13	Wire Assembly, Air Flow Switch	192802-001
14	Tubing, Pressure	192024-002
15	Tubing, Pressure	192024-006
16	Tubing, Connector	192152-000
17	Blower Speed Reducing Panel	192987-000
18	Low Gas Pressure Switch	193222-001
19	Blocked Inlet Switch	192947-000
20	Wire Assembly, Air Flow Switch	192802-000
21	Switch-On/Off	192699-000

Downloaded from www.Manualslib.com manuals search engine

CYCLONE XHE® MODELS
BTH - 250 BURNER & BLOWER PARTS LISTS — SERIES 962



ITEM	DESCRIPTION	BTH - 250
1	Burner	192416-000
2	Igniter Assembly	192638-000
3	Rivet, Blind, 1/8" Dia 316 SS	192730-000
4	Air Deflector	192414-000
5	Air Restrictor	192450-002
6	Barb, Hose, 3/16"	192800-000
7	Flame Rod Assembly	192478-000
9	Orifice	192477-002
10	Orifice Holder	192447-000
13	Valve, Gas	192454-000
14	Blower	193203-000
15	Tube, Air	192469-010
17	Bracket, Blower Mounting	192482-000
18	Flange Assembly, Inlet	192886-000
19	Low Gas Pressure Switch	191149-001

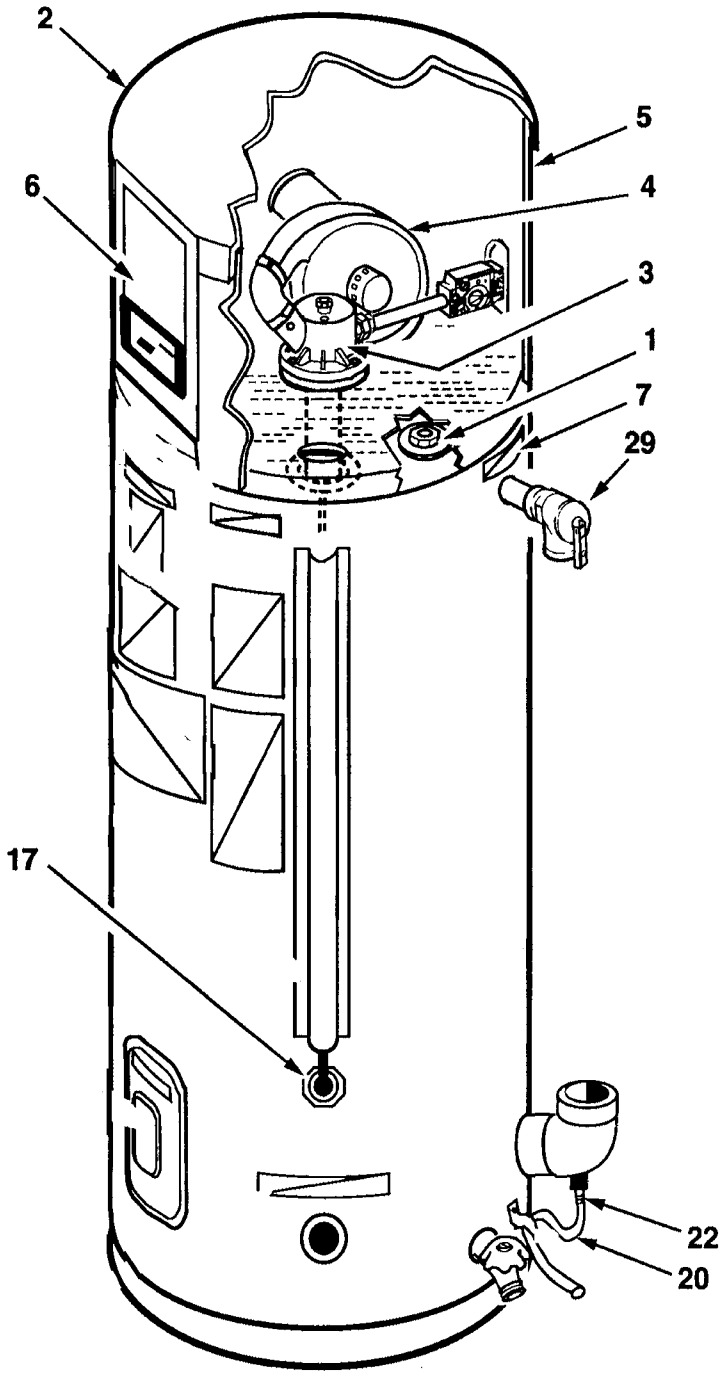
Part numbers in shaded cells are recommended stock items for emergency replacement.

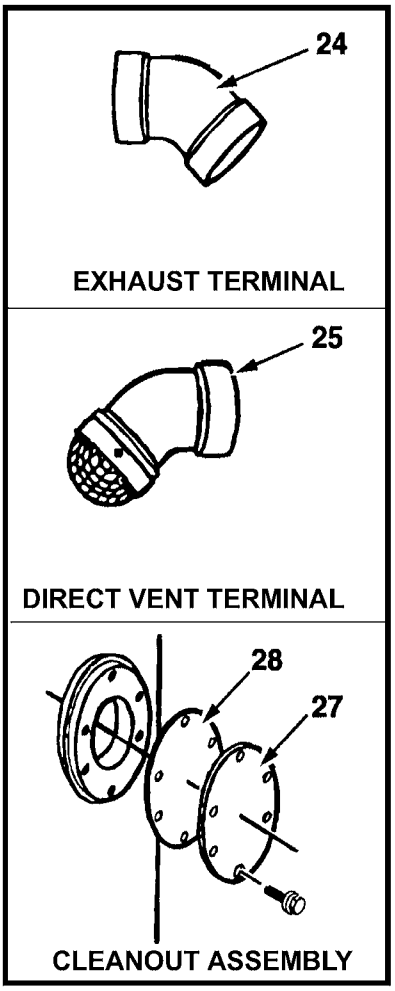
Downloaded from www.Manualslib.com manuals search engine

A.O.SMITH
WATER PRODUCTS COMPANY

GAS

COMMERCIAL WATER HEATER PARTS LIST
CYCLONE XHE® MODEL BTH - 150 & BTH - 199
SERIES 962
(PARTIAL PARTS LISTING)





A. O. SMITH WATER PRODUCTS CO.,INC.
PARTS INFORMATION
PHONE: 1-800-433-2545
FAX: 1-800-433-2515 • WWW.AOSMITHWATERHEATERS.COM

Downloaded from www.Manualslib.com manuals search engine

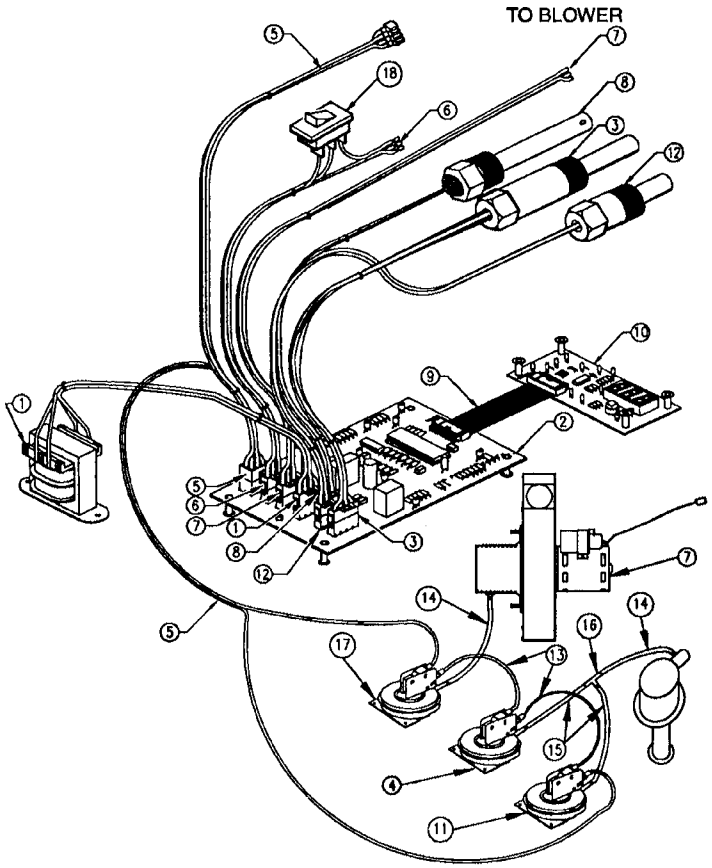
CYCLONE XHE® MODEL
BTH - 150 & BTH - 199 WATER HEATER PARTS LIST — SERIES 962

ITEM	DESCRIPTION	BTH - 150	BTH - 199
1	Anode	043817-053	043817-053
2	Cover, Jacket	192664-00	192664-000
3	Burner Assembly	192417-001	192417-001
4	Motor, Blower	192880-000	192880-000
5	Cage, Housing	192420-000	192420-000
6	Bracket, Control Panel	192716-000	192716-000
17	Temperature Probe, Lower	192609-000	192609-000
20	Condensate Hose	191746-072	191746-072
22	Barb, Hose	181863-000	181863-000
24	Exhaust Terminal	181901-000	181901-000
25	Direct Vent Kit	182167-000	182167-000
27	Plate, Pressure	099037-000	099037-000
28	Gasket	099038-000	099038-000
29	Valve, Relief	191617-000	191617-000

Part numbers in shaded cells are recommended stock items for emergency replacement.

Downloaded from www.Manualslib.com manuals search engine

CYCLONE XHE® MODELS
BTH - 150 & BTH - 199 CONTROL PARTS LIST — SERIES 962

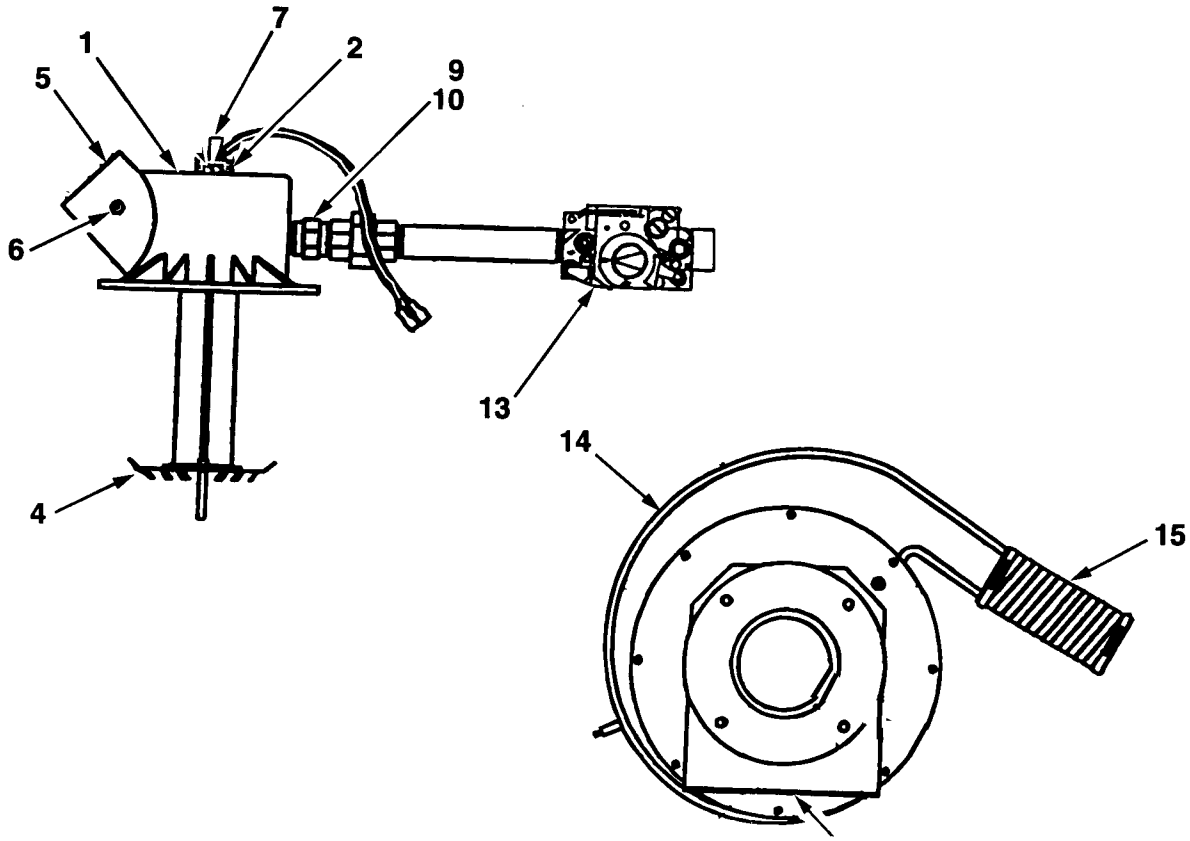


ITEM	DESCRIPTION	BTH - 150	BTH - 199
1	Transformer	192608-000	192608-000
2	Control Board	192624-000	192624-000
3	E.C.O/Temperature Probe	192606-000	192606-000
4	Blower Proving Air Switch	193221-000	193221-000
5	Low Voltage Cable Assembly	192605-000	192605-000
6	Line Voltage Cable Assembly	192607-000	192607-000
7	Blower Assembly	192468-000	192468-000
8	Igniter Assembly	192638-000	192638-000
9	Cable to Control Display Panel	192623-000	192623-000
10	Board, Display Panel	192622-000	192622-000
11	Blocked Flue Proving Switch	192878-000	192878-000
12	Temperature Probe, Lower	192609-000	192609-000
13	Wire Assembly, Air Flow Switch	192802-000	192802-000
14	Tubing, Pressure	192024-014	192024-014
15	Tubing, Pressure	192024-004	192024-004
16	Connector, Tube	192152-000	192152-000
17	Blocked Inlet Proving Switch	192882-000	192882-000
18	Switch-On/Off	192699-000	192699-000

Part numbers in shaded cells are recommended stock items for emergency replacement.

Downloaded from www.Manualslib.com manuals search engine

CYCLONE XHE® MODELS
BTH - 150 & BTH - 199 BURNER & BLOWER PARTS LIST
SERIES 962



ITEM	DESCRIPTION	BTH - 150	BTH - 199
1	Burner	192416-000	192416-00
2	Igniter Assembly	192638-00	192638-000
4	Air Deflector	192414-000	192414-000
5	Air Restrictor	192450-001	192450-001
6	Barb, Hose, 3/16”	192800-000	192800-000
7	Flame Rod Assembly	192478-000	192478-000
9	Orifice	192477-001	192477-001
10	Orifice Holder	192447-000	192447-000
13	Valve, Gas (Honeywell)	192797-000	192797-000
14	Blower	192468-000	192468-000
15	Tube, Air	192469-010	192469-010
17	Bracket, Blower Mounting	192482-000	192482-000

Part numbers in shaded cells are recommended stock items for emergency replacement.

Downloaded from www.Manualslib.com manuals search engine

NOTES:

Downloaded from www.Manualslib.com manuals search engine

COMMERCIAL

Visit the “Information Central” link of www.hotwater.com for a listing of available Service Handbooks.

For additional information contact:

A. O. Smith Water Heaters
500 Tennessee Waltz Parkway
Ashland City, TN 37015
1-800-527-1953
www.hotwater.com

A.O.Smith
Water Heaters

©2005 A. O. Smith Corporation

Part No. TC-044R6

Downloaded from www.Manualslib.com manuals search engine